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EDITORIAL ANNOUNCEMENTS.

THE BRITISH AND EASTERN CONTINENTS edition of the Railroad Gazette is published each Friday at Queen Anne's Chambers, Westminster, London. It contains selected reading pages from the Railroad Gazette, together with additional British and foreign matter, and is issued under the name Railway Gazette.

CONTRIBUTIONS.—Subscribers and others will materially assist in making our news accurate and complete if they will send early information of events which take place under their observation. Discussions of subjects pertaining to all departments of railroad business by men practically acquainted with them are especially desired.

ADVERTISEMENTS.—We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay, EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns* OUR OWN *opinions, and these only, and in our news columns present only such matter as we consider interesting and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers, can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially, either for money or in consideration of advertising patronage.*

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VOL. XLII., No. 20. FRIDAY, MAY 17, 1907.

The monthly bulletins of the Department of Commerce and Labor, dealing with exports, furnish an interesting and instructive commentary on government by agitation. Those who have followed the American provision business know, with Congressman Wadsworth, how excellent our practice has been for many years, and how relatively trivial the imperfections were upon which the 12-in. guns of the administration were unmasked last spring. With cannon fire and blast of trumpet, our beneficent government announced to all the world that American food products were not fit to eat, and the world was duly impressed. Consequently, although our sausages are now canned by internes in white canvas coats, and our corned beef is certified once when it walks up the cattle ramp and again when it goes forth to all nations, protected by a highly discriminating label, our exports of canned beef have fallen off from 56,730,873 lbs. for the 10 months ending with April, 1906, to 13,032,703 lbs., for the 10 months ending with April, 1907. Even bacon, most unsusceptible of deceitful treatment at the hands of a packer, has fallen off 6½ million dollars in export value during the same period, while the normal increases may be gaged by the exports of tallow—not considered a food product except in the far north and hence unassailed—which went up from 78 million pounds to 102 million pounds. Those who can see an analogy between the effect of government by agitation on the provision industry and on the transportation industry are welcome to it.

The month of May is marked by the publication of articles on railroad operation in three of the big magazines, the *Atlantic Monthly*, the *Century* and *Scribner's*. The last two have been noticed in these columns already. That in the *Atlantic* is by Professor Dixon, of Dartmouth. Its subject is accidents, and it is thorough, painstaking and comprehensive, but it has little or nothing that is new for readers of the *Railroad Gazette*. In fact, its author appears to have been a careful reader of this paper. But from the standpoint of the publicist Professor Dixon's article is the most elaborate and discriminating study of this subject that we have seen, and we recommend it to those who have neglected the *Railroad Gazette's* teachings for fear the editors were prejudiced in favor of the railroads and against the general public.

One editor, praising Professor Dixon's article, and quoting his conclusion that lack of good discipline is the fundamental fault in railroading, wants to know why he did not explain the evil influence of the labor unions on railroad discipline, a question which "is in pressing need of immediate and unbiassed investigation." This criticism is, no doubt, sincere; but that word "unbiassed" indicates that the statements of railroad officers, to the effect that the labor leaders are insufferably overbearing, are not fully accepted by the public. We pass along the hint to those of our readers who are interested. Of evidence of this evil we have had much, at many times and places. A prominent trait of grievance committees is to grieve much louder over a brother's loss of his job than over the danger to other brothers, and to passengers, which results from an incompetent brother's keeping his job. But it is time that some superintendent led off in emblazoning a few such cases on the outer walls where all may see. The superintendent who is doing everything in his power to make his discipline perfect is in duty bound to expose everybody who persistently seeks to undermine his work.

Of the 12 or 15 new railroad laws passed in Kansas this year, abstracted on another page, there are three, or possibly four, that have a worthy purpose; all the rest are vicious or foolish. Of the three tolerable ones all have bad features, and one or two that are mostly harmless in effect are really useless—for their purposes, so far as they are good, could be accomplished as well without the statutes. A dozen states have this year passed a variety of useless or unjust railroad laws, but we notice Kansas in particular because of its pre-eminence in variety and wantonness. Putting a railroad man in jail for not properly accommodating stray passengers by carrying them in a freight caboose, and making a criminal of the jailer for failing to abuse the railroad when a car of coal is delayed, seem close to the limit of absurdity. Some of these laws are incomprehensible to one at a distance; as, for example, that for establishing freight terminals. A concealed purpose to punish somebody, presumably, is the explanation of it. The 16-hour labor law (one of those which we class as right in purpose), contains an exception which may largely nullify the good it might do; show-

ing that the main motive of its promoters was not so much to enhance the safety of passengers and trainmen, as to carry out the ignorant or selfish wishes of the labor unions. For special legislation disguised as general, the requirement that car-repairers shall have sheds to protect them from the hot summer suns of the Great American desert is a rare gem. Next we shall have a state appropriation (to be taken out of the railroads' treasuries) to buy umbrellas for all Italian workmen in gravel pits. For a miniature anti-trust law the prohibition of demurrage associations is a cute little model. We fear that local freight agents will evade it by corrupt presents to one another of five-cent cigars. But time would fail us to point out all the funny things in these laws—funny if they were not such sad commentaries on popular government—and we will leave the reader to guess which of these laws we have meant to refer to as possibly useful. The reciprocal demurrage law *may* do some good in spots, but this will be in spite of its wrong principle. For a proper characterization of this kind of a law legislators should read what Hon. Judson Harmon says about it, in another column of this paper.

All who are interested in the literature of the locomotive, and especially the many old friends of Matthias N. Forney, will be glad to know that he has undertaken to produce a revised edition of his well-known book, "The Catechism of the Locomotive." The first edition was published in 1874, and nearly 36,000 copies of it were sold. These went largely to locomotive firemen and locomotive engineers and to those who were ambitious to attain those positions. The simplicity and the completeness of this remarkable book so accurately adapted it to the understanding of these men, and gave them so nearly all of the actual information needed in running a locomotive, that its value was recognized early by superintendents of motive power and other general officers, with the result that on an increasing number of railroads enginemen were notified that examinations for promotion would consist of questions from Forney's Catechism of the Locomotive. In 1890 Mr. Forney was induced, by reason of changes and improvements in the locomotive and an evolution in its construction, and by the results of investigations which had been made of working and theory of the wonderful machine, to prepare and issue a revised and much enlarged edition. This new book was invaluable to the student, but evidently less available to the enginemen, and less than 16,000 copies of it were sold, being only three-tenths of the number sold of the original edition of about one-half size. At the present time this 1890 edition is, in many respects, out of date. It preceded the period of the discovery of the uses of extension front and of compounding, of many attachments and, in addition, there have been changes in proportion, in wheel base, etc. It would seem to be well that Mr. Forney should complete his work, and his plan for doing this is skilful and will interest those who know the needs of enginemen as well as of locomotive engineers and students. The new edition will consist of two parts, each separate and complete in itself. Part I. will be an elementary treatise similar in scope to the first edition. Thousands of boys acquired their basis knowledge of the steam engine from the wonderful first three chapters of this book on the steam engine; the forces of air and steam; and work, energy and the mechanical equivalent of heat. Although this Part I. of the new edition will be elementary and simple, so as to make easy reading for untrained men, nevertheless, it will be thorough and complete in itself in giving to those who read and study it a full knowledge of the principles and details of working of the locomotive engine. Part II. will go much farther. Its chapters will have like headings and there will be some additional chapters, but there will be a description of those features of construction and principles of operation which are more difficult of comprehension. For example, Part II. will include the results of laboratory tests such as have been made at Purdue and at St. Louis. Mr. M. N. Forney's address is at No. 501 Fifth avenue, New York, and he will welcome suggestions from all who are interested.

THE NEW HAVEN—BOSTON & MAINE COMBINATION.

In the course of railroad events, just at that time following each other in rapid sequence, there came in 1893 the territorial division of New England dubbed then the "Partition of Poland." The partition was threefold with the Boston & Maine allotted the North, the Boston & Albany the Center—albeit somewhat circumscribed—and the New York, New Haven & Hartford given well nigh complete possession of the South. It looks now, if the paradox may be pardoned, as though the New England Poland were to be repartitioned into solidity and the earlier distribution reversed. Not absolutely precise, as yet, are the reports that tell of the absorption of the Boston & Maine system by the New Haven. But all the omens nod toward it; the "official" denials are of the strict construction order that play upon the exactitudes of words rather than the exposure of facts; and one can see without abnormally keen eyesight prudential reasons why official announcements should be deemed premature. Any railroad deal where the controlling securities are not actually in hand or the controlling agencies under compact, has its margin of uncertainty. But in this case the margin of conjecture is so small that the combination of the two systems need hardly be treated as a hypothesis.

The immediate causes leading up to the presumptive combination do not have to be sought far away. The untiring energy of President Mellen has supplied the personal force major. Step by step his policy has been pushing its way into rival territory of both the Boston & Maine and the New York Central. The treaty in the "Partition of Poland" has not technically been violated. But the Ontario & Western purchase, the lodgment in trolley systems at Pittsfield, Springfield and Worcester—with intermediate extensions—and the voluntary two cents a mile fares which forced the Boston & Maine—operating in territory with passenger traffic less condensed—to reduce fares also, illustrate the flanking movements and pressures. Closer contacts and collisions running into losing antagonisms have seemed near; and the inert policy of the Boston & Maine has also played into the Mellen hand. From the New Haven viewpoint there has been the constant and, of late, increasing danger that the New York Central by reaching for the Boston & Maine might imperil northern business; and, later still, there has been added some danger that Canadian railroad interests also might extend down and expand in northern New England. The upshot—we repeat, presumptively—is warfare declined and a new treaty in which the Boston & Maine yields itself into the stronger hand with share for share exchange and a 1 per cent. increase in dividend; while, as to the New York Central, it will hardly be surprising if, as the price of non-resistance and cession of sundry vantages like minor trackage rights, one of Mr. Mellen's "clubs," the Ontario & Western, is turned into the Central's arsenal. Mr. Mellen's offer, at the time of the O. & W. purchase, to exchange it for the Boston & Albany will, in this connection, be recalled.

The taking over of the Boston & Maine will front Mr. Mellen with a group of problems some of them new or, at least, different from those faced during the swift four years' advance of the New Haven President. The probable addition of 1 per cent. or some $300,000 to the Boston & Maine annual dividend requirement may be brushed aside as almost trivial in so large a future railroad organization with total gross earnings from all sources of say $130,000,000 a year. Not so trivial are such matters as the new public responsibilities to be assumed as a greater monopoly in five states instead of three, and one of them—New Hampshire—in an "anti-corporation" mood. Nor are the physical problems minor with the New Haven's track mileage of about 2,000 miles more than doubled. There is the great cost of reconstruction and of new equipment; the harmonizing of traffic arrangements; the unifying of terminals at Boston, possibly by subway; such special matters as the digestion of the old Fitchburg system which may be regarded, in a sense, as a kind of long bridge carrying low class through freight traffic; and, beyond, is the question of consolidating the component and subsidiary lines. In many respects President Mellen must repeat, on a system differently located, his policy in developing the New Haven, one branch of which, the acquisition of street railways, will have peculiar interest, not to say obstacles, in its application to the new territory. To the solution of all these problems the New Haven's President will bring some great vantages, besides his own aptitudes and training. He is thoroughly familiar with a region in which he once served as a railroad officer; he has considerable opportunities for operating economies by knitting the two systems together and increasing traffic by continuities of train service, especially between New York and northern New England and Canada; the Canadian lines afford him a new western outlet and inlet; and the New Haven's recently acquired coast lines of steamships have considerable potencies for taking traffic hitherto dissevered from the Mellen system of roads.

The immediate fiscal elements of the presumptive combination are not of very grave moment. It may be noted, however, that the great fixed charge of the Boston & Maine is in rentals ($5,074,554), its debt carrying the relatively low interest charge of $1,474,670, and its present dividend requirement is but $1,834,646, the latter

to be increased probably by about 1 per cent. on the $28,265,500 of outstanding stock, common and preferred, or $282,655, by the union with the New Haven. The system, however, with its large gross earnings from operation—last year $39,214,200—and considerable outside income—has pressed its dividends hard and the first nine months of the present fiscal year show a decrease in net surplus for dividends of $501,549. Like other roads it faces increased cost of operation, particularly from labor, offsetting increase of gross earnings; and its reductions of fares will, it is likely, tell a different story from those of the New Haven with its high density of passenger traffic. But, with normal traffic conditions, it looks nevertheless as though the Boston & Maine system would take care of itself fiscally. Its taking over is, in fact, far less bold than the New Haven's recent assumption together of the Rhode Island street railway system and the Connecticut Railway & Lighting properties. In that great trolley purchase the New Haven absorbed some $35,000,000 of water; in the Boston & Maine the New Haven gets solid stuff throughout.

In the glance ahead into the vistas of the New England railroad situation, as affected by the Boston & Maine absorption, the future of the Boston & Albany must excite acute speculation. Outwardly that line, with its ultra-conservative record and traditions, appears crowded by the New Haven's rushing policy harder than ever. The Mellen strategy has already invaded its territory by electric roads and now it is compassed by the New Haven's steam system also. On its face it seems as though manifest destiny pointed to the New Haven control of the Boston & Albany, and that final act round up New England railroad monopoly. But this is a mere detail. The impressive fact of the present is the vastness as well as the pace of the Mellen policy which in four short years has spread centralized ownership of steam, electric and marine properties over so large an area; the transmutation of what was but lately the most conservative railroad corporation in New England into one of the most venturesome and aggressive in the land; and the size, intricacy and novelty of the new problems in transportation to be worked out under centralized conditions in a territory like New England which, industrially, is both intense and complex. In such a region, quick to reflect both good times and hard times, a Napoleonic policy may lead either to Austerlitz or Waterloo; just now it looks like Austerlitz. But whatever the event, needing now but a few more years to disclose it, the results of the Mellen policy, steam and electric, will be a distinct contribution to the science and methods of American transportation.

FOR BETTER RAILS.

It is perhaps safe to say that there is no more striking example in this country of the dangerous and harmful possibilities of a great corporation than that which is now being afforded by the United States Steel Corporation in its attitude toward demands for sound rails. There is no individual, or combination of individuals, which knows better how to make good rails than does the United States Steel Corporation, with its splendid army of experts. Nevertheless, it knowingly makes rails which break and kill people. The top of ingots are not being cropped off below the point where high phosphorus and impurities are found; specifications, as furnished by railroad companies, are totally disregarded, and rails, especially in the new and heavier sections, are furnished with spots in them so full of impurities and so brittle that they must of necessity break when subjected to the strain of traffic. The Steel Company knows this quite well. The railroad companies also know it quite well. The Steel Company declines to take cognizance of the fact, because this would mean considerable reduction of output although no important loss of material. The railroad companies fail to take a firm stand because, in the interests of the tremendous traffic, which they derive directly and indirectly from the steel companies, they have not yet dared to do so.

Two points here are specially noteworthy: first, the criminal willingness of the Steel Corporation and the companies allied with it to manufacture rails that cost human life; second, the attitude, almost equally criminal, on the part of many high railroad officers, to ignore the plain truths that are being brought before them by their superintendents and chief engineers. At the recent meeting of the American Railway Association in Chicago it was asked by G. L. Peck, General Manager of the Pennsylvania Lines West, that any representative of the 230,000-odd miles of railroads in the United States present at the meeting who was satisfied with the rails he was receiving, should get up; nobody got up. The representatives of the steel manufacturers who were asked to defend their processes of manufacture had nothing to say.

It is obvious that such a state of affairs as this cannot continue, for public safety is involved. Since the year 1901, it has been impossible for railroad companies to have their specifications adhered to. The tremendous increases in rail breakages during these five years, when the Steel Corporation has had the matter in its own hands, are well shown in the tables of rails broken and taken from track in New York State, which are shown in another column. During January, February and March, 1907, 836 rails, rolled in the previous year, were broken and taken from track in the state of New York as against 29 rails, rolled in the year 1901, which broke during the same period. This record may be directly characterized as disgraceful—a disgrace to the reputation of the rail manufacturers, who are fully able to remedy the known defects if they wish to do so. The only answer which the rail manufacturers have brought against the charge is that traffic has grown materially heavier in the last few years, and that track structures, ballast, etc., are insufficient for the strain which is put upon them, with the result that high spots and low spots occur in the track, causing breakages which cannot be avoided. They suggest as a remedy the use of a still heavier rail section, weighing perhaps 150 lbs. to the yard. But it has been conclusively shown that the 100-lb. rails of 1905, 1906 and 1907 have made a far worse record in breakages than the 80-lb. rails rolled five years ago; therefore, it is evident that no help is to come from increased weight of section until better processes of manufacture are co-ordinately employed. The exact details of specification, already quite generally agreed on, and the proper shape of the cross-section, not so fully agreed to, need not be discussed at present. The trouble at the root of the present situation does not lie here. Heavy rails of the present day are materially deficient owing to three causes, capable of considerable subdivision, which can be outlined roughly as below:

(1) Phosphorus and impurities which collect in the top of the ingot during cooling require that about one-third of the ingot should be cut off before the rails are rolled. Present practice in the steel mills cuts off a much smaller amount than this, leaving the ingot full of impurities, and with its phosphorus much higher than that allowed by the best specifications.

(2) With the Bessemer process and the ores now used, it is extremely difficult to keep down the phosphorus. A high phosphorus content with high carbon added to give hardness and wearing qualities makes brittle steel. Open hearth rails, of course, furnish the solution of this difficulty.

(3) In the efforts for output, rails are being finished at too high a temperature, and are not receiving enough work in the rolls. Before this can be completely remedied, it is probable that some change in the form of the cross-section will be necessary, but many of the gravest defects arising from rolling can be remedied while the section remains in its present shape.

The recent action of Mr. Harriman in ordering 150,000 tons of open hearth rails from the Tennessee Coal & Iron Company and in throwing down the gage to the Bessemer steel makers adds much interest to the present situation. Mr. Harriman and his system are both big enough to be above the necessity of the traffic diplomacy that ties most of the railroads hand and foot, in a crisis like this. He reported 449 rails broken on his lines during February, of which 179 were 90-lb. rails that had been in the track only five or six months, and accepted Mr. Kruttschnitt's suggestion that damage claims should be instituted against the steel companies for the preventable harm thus done. By taking this position, he has greatly strengthened the hands of the committee of the American Railway Association.

A collection of letters, bearing on this subject, which we regret we must print unsigned and unidentified, will be found in another column accompanied by a series of photographs of broken rails, which constitute a terrible document of the utter lack of responsibility which has characterized the steel companies within the last few years in supplying such a product, upon the strength of which human lives depend. The United States Steel Corporation definitely refuses to make rails according to specifications of chemical composition and details of rolling, while at the same time it is selling rails to the Japanese government for ten dollars a ton less than the price in this country, and is adhering to the required Japanese specifications.

A careful reading of these letters from railroad officers makes it apparent that the roads which have suffered have been those combining heavy rails and heavy axle loads; that is to say, that the rails now made to carry maximum traffic are not capable of always performing their task. The need for a better and more scientifically unified railroad superstructure to carry great train

loads is admitted by all. Mr. Cuenot, the French engineer, discusses some of these superstructure problems in the serial papers which we are now printing. But defects in superstructure do not excuse gross imperfections in 100-lb. rails! How gross these imperfections have become, a glance at the photographs on another page will show.

Train Accidents in April.[1]

Our record of train accidents occurring on the railroads of the United States in April includes 15 collisions, 15 derailments and three other accidents, 33 accidents in all. This record is not published in full, as was formerly done, except in the cases of the few accidents which are especially prominent—in the present instance four collisions and two derailments. The record of "ordinary" accidents—which term includes, for our present purpose, only those which result in fatal injury to a passenger or an employee or which are of special interest to operating officers—will henceforth be given as below, in the shape of one line items, for each accident, showing date, location, class and number of deaths and injuries.

This record is based on accounts published in local daily newspapers, except in the cases of accidents of such magnitude that it seems proper to send a letter of inquiry to the railroad manager. The official accident record published quarterly by the Interstate Commerce Commission is regularly reprinted in the *Railroad Gazette*. The six prominent accidents in April are distinguished in the list by printing the name of the road in italics. Following are condensed accounts of the circumstances of these six accidents.

The derailment at Bartlett, N. Dak., on the 15th, is reported as unexplained. The westbound Oriental Limited express, running at about 40 miles an hour, was derailed on a low embankment and the first three cars were completely wrecked. The track was straight and in good condition. The wreck took fire from the firebox (not from the gas tanks under the passenger cars, though some of these exploded later) and seven passenger cars were burned up. Four passengers and one mail clerk were killed and 27 passengers and five trainmen were injured.

The collision at Mableton, Ga., on the 6th, was due to a misplaced switch, the switch having been left misplaced by a freight train at end of double track. The operator failed to throw the switch to the proper main track. Three engines and five cars were wrecked. Six trespassers were killed and three trainmen and five trespassers were injured.

The collision at Bethel, Tex., on the 2d, was between a northbound and a southbound freight train. Both engines and eight cars were wrecked and both enginemen, both firemen and two brakemen riding in the engines were killed. The collision was caused by an operator accepting an order for the northbound train after it had passed his station. The wreck took fire and was burnt up. The bodies of the two brakemen and of many cattle were cremated.

The rear collision of freight trains near Knoxville, Tenn., on the 21st, occurred in a tunnel, and the fire which broke out in the wreck destroyed a locomotive, a caboose and three coal cars, and badly damaged 1,000 ft. of the timber lining of the tunnel.

The derailment near Kennewick, Wash., on the 23d, resulted in the wrecking of 21 cars loaded with lumber, most of them falling through a trestle bridge over which the train was running when the car with the broken wheel finally was wrecked. Of the men killed three were trainmen and the fourth apparently was a trespasser.

The collision at Cajon Pass, Cal., on the 23d, was due to a cause which appears frequently in the records of freight train accidents but rarely in connection with passenger trains—the leaving of a train unattended on a grade with nothing but the air-brakes to keep it from running away. The engine of a passenger train having to be detached to assist a freight which had run off the track, the passenger cars were left standing on the grade a half mile above the obstruction, and after standing there some time, these cars moved down the grade and ran violently into the passenger engine. A section foreman was instantly killed. A brakeman was injured and several passengers were slightly hurt.

[1]Abbreviations used in Accident List:
rc.....Rear collision.
bc.....Butting collision.
xc.....Other collisions; as at crossings or in yards. Where only one train is mentioned, it is usually a case of a train running into a standing car or cars, or a collision due to a train breaking in two on a descending grade.
b.....Broken.
d.....Defective.
dr.....Defect of roadway.
eq.....Defect in car or engine.
n.....Negligence.
unf.....Unforeseen obstruction.
unx.....Unexplained.
derail....Open derailing switch (negligence of engineman or signalman).
ms.....Misplaced switch.
acc. obst..Accidental obstruction.
malice....Malicious obstruction of track or misplacement of switch.
boiler....Explosion of boiler of locomotive on road.
fire.....Cars burned while running.
Pass.....Passenger train.
Ft.....Freight train (includes empty, engines, work trains, etc.).
*Wreck wholly or partly destroyed by fire.
†One or more passengers killed.

Train Accidents in the United States—April, 1907.

Collisions.

Date.	Road.	Place.	Kind of Accident.	Kind of Train.	No. persons reported Kil'd.	Inj'd.
*2.	*Mo., Kan. & Texas*	Bethel.	bc.	Ft. & Ft.	6	0
4.	Atch., Top. & S. F.	Los Angeles.	rc.	Ft. & Ft.	1	2
4.	Illinois Central	Duquoin.	rc.	P. & Ft.	1	0
6.	*Southern*	Mableton.	xc.	Ft. & Ft.	7	2
8.	Cin., N. O. & T. P.	Chattanooga.	bc.	Ft. & Ft.	0	1
*11.	Boston & Albany	E. Chatham.	rc.	P. & Ft.	1	1
15.	Denver & Rio Grande	Larkspur.	bc.	Ft. & Ft.	0	3
15.	Wabash	High Hill.	rc.	Ft. & Ft.	2	4
16.	Atlanta, B. & A.	Augilla.	bc.	P. & Ft.	1	0
21.	Southern	Woodlawn.	rc.	P. & Ft.	2	3
*21.	*Louisville & Nashvle.*	Knoxville.	rc.	Ft. & Ft.	0	2
23.	*Atch., T. & S. Fe*	Cajon Pass.	xc.	Pass.	1	4
24.	Chicago & Alton	Dwight.	xc.	Ft. & Ft.	2	3
24.	Phila. & Reading	Wilmington.	xc.	Ft. & Ft.	1	0
26.	N. Y., Phil. & N.	Eden.	bc.	P. & Ft.	1	2

Derailments.

Date.	Road.	Place.	Kind of train.	Cause of derlmt.	No. persons reported Kil'd.	Inj'd.
5.	St. L. & San Fran.	Catoosa.	Pass.	unx.	0	3
6.	Pennsylvania.	Hudson.	Pass.	malice.	0	1
8.	Southern Pacific	Brown's.	Pass.	d. switch.	1	6
†10.	St. Johnsbury & L. C.	Hardwick.	Pass.	unx.	1	15
*13.	Central of Georgia.	Cataula.	Ft.	burn. bdge.	1	0
10.	Oregon R. R. & Nav.	Cayuse.	Pass.	washout.	4	4
14.	Balt. & Ohio	Sullivan.	Pass.	unx.	1	1
*14.	Texas & Pacific	Cheneyville.	Pass.	mal. m. s.	3	1
*15.	*Great Northern*	Bartlett.	Pass.	unx.	5	32
15.	N. Y. Central	Blossvale.	Ft.	unf.	1	1
17.	Southern	Choccolocco.	Ft.	unx.	1	2
22.	Great Northern	Blaisdell.	Pass.	b. rail.	0	12
23.	*Northern Pacific*	Kennewick.	Ft.	b. wheel.	4	0
26.	Hous. & Texas Cent.	Burnett.	Pass.	b. bridge.	0	7
28.	Wabash-Pittsburg	Bridgeville.	Pass.	unx.	2	0

Other Accidents.

14.	N. Y. Central.	Canandaigua.	Ft.	boiler.	0	4
27.	Wabash.	O'Fallon.	Ft.	boiler.	3	2
29.	Cranberry Lake	Wanakena, N.Y.	Pass.	boiler.	2	5

General Electric Company.

The fifteenth annual report of the General Electric Company records the results of by far the most prosperous year in its history. Total sales (amount billed to customers) for the year ended January 31, 1907, were $60,000,000 as against $43,100,000 for the year ended January 31, 1906, which was the previous record figure. Last year's profits, after deducting all general and miscellaneous expenses, all expenditures in connection with patents and patent litigation, $2,834,124 written off from the book value of factory plants, and other allowances for depreciation and loss, were $8,427,843 against $7,319,161 in the previous year. Dividend payments were $480,000 larger than in 1906, in spite of which net income after dividends was over $600,000 more than in that year.

Ten years ago, on January 31, 1897, patents, franchises and good will stood on the company's books at $8,000,000. Eight years later this had been reduced by successively writing off sums out of earnings to $2,000,000. In 1906, $1,000,000, and in 1907, $999,999 were written off, so that this account on the balance sheet is now carried at the nominal sum of $1. After deducting the amount written off last year from the net income after dividends, the balance, $3,083,502, was carried to profit and loss, bringing up the profit and loss surplus to over $15,100,000.

Sales during the past year were almost $17,000,000 more than in 1906, an increase of about 40 per cent. This is much better even than the General Electric Company's record for the previous 10 years, during which the average increase in sales was 13 per cent. a year. Total sales in 1907 were over twice as much as in 1901. In this connection it is interesting to know that the sales for the first two months of the present fiscal year (February and March) were over 50 per cent. greater than for the corresponding months of 1906. President Coffin remarks that if this growth in business continues new capital will soon be required. The physical growth of the company within the last few years can be seen from the fact that the floor space in factories was over twice as great in 1907 as in 1901, and the employees two and one-third times as many.

Of the expenditures during the year on the factory plants at Schenectady, N. Y.; Lynn, Mass., and Harrison, N. J., including real estate, machinery, patterns and sundries, 74 per cent. has been written off, the remainder, $1,000,000, having been added to this account on the books. This brings up "factory plants" to $9,000,000, which covers a book value on January 31, 1893, of $4,000,000 and an expenditure during the 14 years since that time of $23,200,000, a total of $27,200,000. Of this total, $18,200,000 has been written off during the 14 years.

To provide for the new capital which is likely to be needed the company has $14,800,000 stock authorized but not issued. The total authorized is $80,000,000, of which $54,286,750 was outstanding on January 1, 1906, and $10,847,600 has since been issued.

Under the head of engineering, the successful working of electric traction on the New York Central and on the West Jersey & Sea Shore line of the Pennsylvania from Camden to Atlantic City is mentioned. During the year Curtis steam turbo-generators of an aggregate capacity of 350,000 h.p. were sold, of which 37 were for Japan and others for other foreign countries. The first of the

company's great 8,000-k.w. turbine machines was put in service during the year by the Chicago Edison Company and has been in daily operation since September, 1906, with loads sometimes as high as 14,000 k.w. Five similar machines have since been installed. The size and voltage of transformers for use in long distance transmission work continues to increase. There have lately been ordered a number of transformers of 7,500-k.w. capacity for operation at 104,000 volts. A notable instance of development of high tension switching apparatus has been the successful design and testing of a switching device for 100,000-volt operation.

Except in the fact that the report does not give detailed information about securities held which make up over $20,000,000, or nearly one-fourth of the assets, it gives useful details of the company's operation during the year. The exact figures of sales, collections and unsettled or unmatured balances at both January 31, 1906 and 1907, as well as the allowance made at each date for losses on notes and accounts receivable, are especially valuable in assuring the sound financial position of the company. The amounts written off for depreciation show that, besides making large profits, the company is conservatively maintaining and improving its property.

NEW PUBLICATIONS.

Concrete and Reinforced Concrete Construction. By Homer A. Reid. New York: The Myron C. Clark Publishing Co. 884 pages; 6 in. x 9 in.; 715 illustrations. Cloth; Price, $5.00.

The advance that reinforced concrete has been making by leaps and bounds during the past few years makes books of this character of particular interest and value to engineers, especially when the work is as well done as it is in this instance. As will be seen from the outline this is a large volume copiously illustrated not only with examples from the best practice, but, with what is of equal value, examples of occasional failures by which a warning is raised against certain methods of construction that should be avoided.

So much has been published regarding cements and cement testing that the author touches upon this branch of the subject but briefly. There is a short review of the history of cements, the materials of which they are made, the methods of inspection and testing, and the facts that must be taken into consideration in working for strength and durability. In this especial attention is paid to the general methods of mixing and placing and the effects on the physical properties which are discussed in a chapter by themselves. Then comes the styles of reinforcement and the principles that underlie the use of the various shapes, together with the physical properties of the metals that are used, showing how the concrete and its reinforcement must be made to act and work together in order to produce satisfactory results. In this especial emphasis is put upon the fact that where all tension stresses are to be carried by the reinforcement, the yield under the maximum stress must not exceed .001 of the linear dimensions if the integrity of the structure is to be preserved. In the treatment of this portion of the subject the theory of beams is given a chapter by itself and in it the several formulae that are used are worked out with copious explanations, with especial attention to monolithic floor construction where the ribbed method is used. Columns are treated with the same thoroughness, and so it is not until the middle of the book and the chapter on foundations is reached that we enter upon the discussions of the details of reinforced concrete, and by this time the reader who has carefully followed what has gone before is prepared to understand the reasons why certain types of construction are used. In what follows, foundations are treated in detail, and the forms of piles and footings discussed, together with styles of building and practical construction, retaining walls, dams, conduits. sewers, tanks, reservoirs, chimneys, tunnels and bridges. This portion of the book not only gives copious illustrations of successful examples of construction, but analyzes the interaction of the concrete and the reinforcement and shows the service that each can be depended upon to render and the manner in which that service is rendered.

In his preface the author states that it has been his aim to make the book "a complete treatise on the properties of concrete and reinforced concrete, as applied to construction," and it is only fair to say that he has met with a large measure of success. The subject is so extensive that a smaller volume would have necessitated undesirable condensation, and it is only after a careful review of the book that the engineer, who has not been in the thick of the fight of its introduction can realize the extent to which this new combination has come and is coming into use. It apparently embodies the desirable features of steel construction and masonry, and by this happy union is invading the fields of both to such an extent that, as Mr. Reid says, we are in danger of going concrete mad, and against this he voices the word of caution that we are to remember "that reinforced concrete does not possess wonderful and mysterious properties such that it may be unscientifically and recklessly used. On the contrary, it should be used with the same care and judgment that has made other and older kinds of construction both safe and satisfactory." The author has evidently used the opportunities afforded by his position as engineer on the Bureau of Buildings to good purpose in gathering the materials by observation and practice from which the book is made up, and has succeeded in so putting them together as to make it a valuable work, and while he is evidently an enthusiastic believer in this type of construction, he also believes that its use should be "tempered with good judgment," for unless this is done "the ethics of good engineering will be violated."

North American Railroads; Their Administration and Economic Policy. By W. Hoff, Superior Privy Councillor, and F. Schwabach, Privy Councillor. The Germania Press, 5 Beekman street, New York City. Special expert private translation. Heavy paper; 447 pages, 8½x11 in. Full leather. Price, $25.

Readers of the *Railroad Gazette* are already familiar with the scope of this voluminous report, parts of which we published last fall. The two German councillors, sent by their government to see and describe American transportation conditions, reported in the greatest detail upon a wide range of topics, and now show us our own railroad system as viewed by German eyes, and add much that is curious and interesting in their comment upon differences in practice and the differences in racial temperament which have occasioned them. The *de luxe* edition at hand is a faithful and intelligent translation of the original, well adapted for presentation purposes, and a desirable addition to a railroad library. So far as we know, it is the only complete translation which has been made of this valuable report.

Facts About the South. By Richard H. Edmonds, Editor of the *Manufacturers' Record*, Baltimore, Md.: *Manufacturers' Record* Publishing Co. 72 pages. Price 50 cents, cloth; 25 cents, paper.

This is a summary of articles which have appeared in the Manufacturers' Record showing the growth and magnitude of the South as a commercial and industrial region, particularly with regard to its material progress during the past 10 years. It contains many tables of statistics, considerable historical matter and much optimism as to the future of the South. It is a record of large achievement and a forecast of larger growth.

CONTRIBUTIONS

Superelevation.

Pittsburg, Pa., May 10, 1907.

TO THE EDITOR OF THE RAILROAD GAZETTE:

Referring to the communications by Mr. John A. Fulton, in your issues of April 12 and May 3, on the subject of Superelevation, the writer of these articles has so far failed to grasp the simple elementary principles involved, that some notice of his error seems to be called for, lest the young engineers of the country be led astray.

First.—He used the term centripetal force after the manner of certain text books of past generations, not realizing that in the field of mechanics there is no such force. There may be resistance to centrifugal force producing radial stress; but the term centripetal force can have no application outside of the law of gravitation, and of magnetic attraction.

Second.—Mr. Fulton seems to have studied the case solely from the point of view of the friction of car wheels on steel rails, forgetting that car wheels have flanges having a certain function which they perform admirably.

Third.—The question of superelevation involves only a simple elementary problem in the composition and resolution of forces.

In Fig. 1, let g W represent the weight of the locomotive, and g F the centrifugal force due to the velocity and weight of the moving mass, and the radius of curvature, both acting through the center of gravity g. Then g R will be the resultant of these two forces.

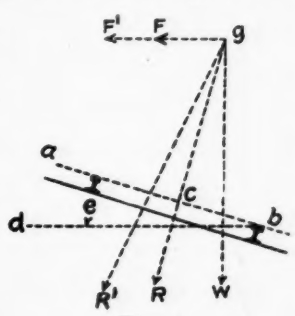


Fig. 1.

If the angle a b d of the superelevation is equal to the angle R g W then the resultant g R will cut the plane of the rail heads at the center of gage C; consequently the pressure of the load will be equally divided between the two rails, and its direction will be normal to that plane. In this case there can be no tendency to lateral movement.

If the speed exceeds that for which the elevation e has been determined, then the centrifugal force g F′ will be greater than g F, and the resultant g R′ will cut the plane of the rail heads at some point between the center c and the outer rail. In this case the pressure will be unequally divided between the two rails, the outer one bearing the larger proportion.

The difference F F′ between g F and g F′ will then be a disturbing force against the head of the outer rail, tending to cause it to slide or overturn as the case may be. The resistance to sliding depends on the details of the fastenings by which the rail is se-

cured. The overturning force may be readily analyzed after computing, for any given case, the difference F F' of the centrifugal forces, and the portion of the load borne by the outer rail, which counteracts the overturning tendency. The method of treatment is so elementary that it will readily occur to every competent engineer, and need not be elucidated here.

This does not take note of the guiding pressure of the flange against the rail head, which is a different problem.

THOS. H. JOHNSON.

The Profitable Weight and Speed of Freight Trains.

Union Pacific System,
Chicago, April 17.

To the Editor of the Railroad Gazette:

Concerning Mr. M. B. Wild's criticism of my previous letter: In order to arrive at a clear understanding of the question at issue, we will refer back to Mr. Wild's first statement, which showed that for moving 2,000,000 loaded car-miles the cost per loaded car-mile at varying speeds in miles per hour between terminals would be as follows:

10	miles	1.9 cents.
15	"	2.0 "
20	"	2.3 "
25	"	2.4 "
30	"	3.0 "

In other words, that for this amount of traffic the low speeds were cheaper. An additional computation provided that, since because of alleged greater rapidity of car movement locomotives at higher speeds could handle more ton mileage in a given number of hours, the net earnings on this additional ton mileage should be added to the net earnings on the original 2,000,000 loaded car-miles to show that more net revenue was produced by the same number of locomotives at higher speeds. The conclusion is obvious, even using his figures, that had the roads sufficient locomotives to move the additional traffic referred to at lower speeds, the cost of movement would be much in favor of such speeds; in other words, in making his comparison of net earnings at different speeds he compares the returns on moving 2,000,000 loaded car-miles at low speeds with the returns on a considerably larger volume of traffic at high speeds.

Now, the question naturally arises as to why Mr. Wild takes 2,000,000 loaded car-miles as the point below which it is cheaper to move traffic at low speeds and beyond which it is cheaper to move traffic at high speeds. Why could not another statistician with equal consistency take 5,000,000 or 10,000,000 as the limiting point, or even go further and take the entire ton-mileage of the railroads in the United States? In this connection it is interesting to note that, as shown by statistics of railroads of the United States published by the Interstate Commerce Commission for 1905 as compared with 1902 (the first year for which information is published), the ton-mileage of freight handled has increased only 18 per cent. and passenger-mileage 21 per cent., yet the tractive power of locomotives provided to move it increased 36 per cent., indicating that there has been considerably more available motive power to move traffic than in previous years when there was no question of congestion.

A review of the statistics published by the Interstate Commerce Commission will show that with but little change in traffic rates the effect of an increase in the past 10 years in prices of material (in many cases from 50 to 75 per cent.), and a general increase in the price of labor, has been just about neutralized by economies due to heavier loading of trains, which have provided greater revenue for each train-mile run. Therefore, it would seem equally evident that had the current traffic of the roads of the United States been handled in smaller train loads as suggested by Mr. Wild because of increases in speed, the expense of its conduct would be vastly increased because of the increased train mileage that would have to be run on account of the loss of locomotive tractive power wasted as a result of faster speed requirements, to say nothing of increased liability to accident because of greater speed.

It seems to me perhaps the greatest objection to Mr. Wild's computation is that it is physically impossible to carry the relative loads shown in his table at the speeds he mentioned, inclusive of delays. Even if the speeds were *exclusive* of delays, the reduction of load in accordance with speed is not great enough according to accepted resistance curves. For example, comparing speeds of 10, 15 and 25 m.p.h., Mr. Wild estimates the cars per train would be respectively 40, 35 and 24. According to the curve of the Master Mechanics' Association, if 40 cars can be handled at 10 m.p.h. on say a four-tenths of 1 per cent. grade, which is a fair one to take, only 32 cars could be moved at 15 and 20 cars at 25 m.p.h. However, the fact seems to have been lost sight of that to make a speed of 25 m.p.h. inclusive of delays, which he calls the most economical one, vastly higher speed must be made when actually running between stations than for lower speeds per hour inclusive of delays, as the delay item is constant and is certainly as great for the higher speeds as for the lower on account of the greater number of meeting points because of increased train mileage to move an equivalent traffic, whilst the total running time from which delays must be deducted to get the allowance for actual running time is much smaller in the case of higher speeds. For example, let us take speeds of 10, 15 and 25 m.p.h. for a division say 120 miles long, allowing, say, a minute to the mile for delays en route, taking water, meeting trains, etc., which is none too much. We have then the following:

Speed per hour between terminals, including delays	10	15	25
Length of run, miles	120	120	120
Running time between terminals, including delays	12 hrs.	8 hrs.	4 hrs. 48 min.
Allowance for delays, 1 min. per mile	2 hrs.	2 hrs.	2 hrs.
Running time, excluding delays	10 hrs.	6 hrs.	2 hrs. 48 min.
Speed per hour, excluding delays, miles	12	20	43
Estimated loaded cars per train that could be hauled at these speeds	36	25	8
Estimated loaded car-miles per eng.-hr.	360	375	200

The above indicates that 25 m.p.h. *including delays* is not only an impracticable freight train speed on account of excessive speed necessary between stations, which reduces the train load to extremely small proportions, but that little more than half as many cars can be gotten over the road per engine hour as at speeds of 10 to 15 m.p.h., including delays, to say nothing of less safety in operation and enormous increase in the number of trains run to handle a given traffic.

Speeds of between 10 and 15 m.p.h., such as found in existing railroad practice, fit in well with employees' wage schedules, do not require overtime, and require about the right speed between stations to handle the maximum traffic to the best advantage.

W. A. WORTHINGTON.

The Rehabilitation of the Brooklyn Rapid Transit Company.

(*Concluded.*)

The previous article outlined the history of the Brooklyn Rapid Transit Company and the condition of the property in 1902, when Mr. Winter was made President and began the work of rehabilitation, concluding with a description of the new elevated shops and yards at East New York and at Thirty-sixth street. This article describes the many other physical improvements recently made, including surface car barns, terminals, reconstruction of tracks and elevated structures, new rolling stock and power house equipment.

At Ninth avenue and Twentieth street a new and modern surface car barn and shop has been built during the last year. This plant, like the two new elevated terminals, is notable as an example of the most approved construction and arrangement. It was designed to be as nearly fireproof as possible, not only to reduce the insurance rate, but more especially to protect the company against a severe crippling of its service in the event of the destruction by fire of the cars stored there. The new buildings occupy the whole block between Ninth and Tenth avenues and Nineteenth and Twentieth streets. The old depot of the Nassau Electric Railway formerly stood at the corner of Ninth avenue and Nineteenth street and an open storage yard had been built in the rear. The old building was torn down and the open storage yard covered with fireproof sheds. The storage tracks were occupied during the entire rebuilding.

Back from Ninth avenue the ground slopes away and this contour was taken advantage of by making the building fronting on Ninth avenue two stories high, the lower level being below the street and reached from the Tenth avenue end. The building is of brick and reinforced concrete throughout. At the north end, on the Ninth avenue level, are 10 stub-end storage tracks in five bays, each separated by a firewall. The floors are reinforced concrete with vault lights for lighting the storage tracks on the level below. The roof is of the saw-tooth type. The south end of the building contains, on the street level floor, offices for the operating department, wash and locker rooms and a large recreation room with pool tables and bowling alley for motormen and conductors. On the floor below are the boiler room, store room and repair shop.

The track entrance to the low level is from Tenth avenue. There are 14 tracks in bays of two tracks each, separated by firewalls which are carried up 3 ft. above the roof as an additional precaution. The storage shed, covering the greater part of the tracks on the low level, is one story and of fireproof construction throughout. It is separated from the building facing on Ninth avenue by a clear space of 50 ft., but the tracks are continued into the lower floor of the other building. The four tracks on the south side are used for inspection only. Such cars as need repairs are run on through to the shop in the adjoining building which is served with an overhead traveling crane for dismantling. All cars using this terminal are regularly inspected every three days and overhauled every 30 days, as on the elevated lines. For convenience in running cars in and out of the depot without interfering with operations of cars continuing on beyond, two tracks have been laid completely around the block. The inside track connects with all the storage tracks; the outside track is used as a through running track. This saves much wear and tear on the special work connecting the storage tracks. From the corner of Tenth avenue and Twentieth street connection is made by a double-track line down Gravesend avenue, with the Culver line to Coney Island, which

turns into Gravesend avenue at Thirty-sixth street. This depot thus affords a convenient starting point for extra cars during the rush hours. The cost of these car barns and shops was $445,000.

The old terminal station of the South Brooklyn Railway at Thirty-eighth street and Second avenue was rebuilt in 1903-1904 and new machinery installed for a general repair and paint shop for surface cars. This improvement cost $100,000, and while not to be classed with the Ninth avenue depot, affords the needed facilities for carrying on this class of work. A new surface car depot is now in course of construction at Maspeth to replace the old depot at that point, and a storage and inspection shed for the Myrtle avenue elevated line is building at Fresh Pond road on the Lutheran cemetery extension. Large amounts of money have been spent on surface car storage yards at other points.

In order to provide for more efficient and convenient distribution of traffic between elevated and surface lines important changes were made in most of the outlying terminals to facilitate the transfer of passengers. Because of the failure of the city to make suitable arrangements for improvements at the Brooklyn Bridge little has been accomplished in that direction to relieve the crush during the rush hours in the morning and at night. At other times, however, through service to the New York end has been provided by making connections (in 1904) with the bridge tracks from Fulton street and Adams street. The present switching tracks and platforms at the New York end can accommodate only five-car trains, and, as the shuttle cars running over the bridge are wider and will hold from 20 to 25 per cent. more passengers than the standard elevated cars, no through elevated service is attempted during the rush hours, when the capacity of the bridge is taxed to its utmost. The changes at the Brooklyn end afford only a small measure of the needed relief, but until an entire rearrangement of the bridge terminals at both ends and the method of operating is carried out, little more can be done. Work is now under way on the subway loop connection between the Williamsburgh and Brooklyn bridges which, when completed, should afford much better operating conditions.

At the Williamsburgh plaza in Brooklyn a well designed system of surface car loops and connections has been built at a cost of about $80,000. Ample space was available here but the temporary terminal at the New York end supplied by the city is unsatisfactory and entirely inadequate. No physical connection has yet been made between the elevated tracks on the bridge and the Broadway line of the Brooklyn Rapid Transit. In 1904 also, four additional loop tracks for surface cars were built at the New York end of the Brooklyn Bridge at a cost of $100,000, doubling the capacity of the surface terminal.

The surface lines converging at the terminals of the elevated lines in the outlying districts collect and distribute large numbers of through passengers bound for New York. As an extension of the free transfer privilege the company made arrangements at these points for transferring through passengers from the surface lines to the elevated lines and vice versa, thereby relieving the surface lines as far as possible of the unavoidable congestion in the downtown district and greatly reducing the total car mileage.

At Thirty-sixth street and Fifth avenue, in connection with the new shop built at that point, the station was entirely rearranged. The Bay Ridge and West End elevated lines come in from the south and west and the Culver and Sea Beach lines from the east. These lines converge into two northbound and two southbound station tracks which can be occupied by trains from either division. The station tracks extend about 500 ft. beyond the platforms before entering the double-track Fifth avenue structure leading into the city. With this arrangement eight trains may be standing in the station at one time and when necessary one train can pass another on the adjoining track. Free transfers are issued to passengers leaving elevated trains and likewise by conductors of surface cars to passengers taking trains. The station is operated with an all-electric interlocking plant controlling train movements in both directions, and, during the rush hours of the summer time, when large crowds to Coney Island are being handled, it is very busy, but seldom congested.

Similar but less elaborate terminal arrangements have been established at Ridgewood, East New York, Cypress Hills and Bay Ridge. At Prospect Park station on the Brighton Beach line at Sterling place, the elevated trains run in an open cut. Surface cars formerly ran over the same tracks to the beaches, but now the surface car lines centering at this point run around an overhead loop and transfer all passengers to the trains below.

The terminals at Coney Island have been completely rebuilt to meet the rush of the enormous summer traffic. The most important is the Culver terminal, which is used by all surface cars running to Coney Island proper, and by the elevated trains of the Culver and Brighton Beach lines. It is on Surf avenue, the principal thoroughfare, in the heart of the amusement parks. There are four stub-end tracks for elevated trains which will accommodate six-car trains and on which 42 trains an hour can be handled in and out. Five surface car loops under a shed to the west can handle 300 cars an hour. All the tracks are protected by a mechanical interlocking machine with 54 levers. In connection with the terminal are an inspection pit and shop for light repairs, a sub-station, trainmaster's office and employees' waiting room and restaurant. A large storage yard was also built in which to hold the cars necessary for the rush of homewardbound traffic in the evening.

West of the Culver terminal on Surf avenue is the terminal of the Sea Beach line over which express trains are run to New York. Only minor changes have been made here. Still further west is the terminal of the West End elevated line, which skirts the shore of New York bay through Bensonhurst, Fort Hamilton and Bay Ridge to Thirty-sixth street depot. The storage yards and interlocking plants in connection with these two smaller terminals have been remodeled and enlarged.

The total expenditures from October, 1902, up to and including December, 1906, for shops, car barns and new terminals were a little more than $1,800,000.

The amount spent on tracks and structures during the same period was $4,300,000. The largest single item in this list is $675,000 already spent on the improvement of the Brighton Beach line, which will cost, when finished, about $2,500,000. This improvement will eliminate all grade crossings between Franklin avenue, where the line leaves the Fulton street elevated structure, and Brighton Beach. Between Church avenue and Brighton Beach the line is being four-tracked and a through express service will be run with a local service on the outside tracks.

The double-track line turns south from the Fulton street elevated at Franklin avenue on an elevated structure over private right of way. This is to be abandoned. A solid earth fill between concrete retaining walls is being built to Park place, where the tracks enter an open cut. This fill is being made wide enough for four tracks, if they are eventually needed, and will materially improve the alinement. From Park place to Sterling place, where a transfer terminal has been built, the line is depressed in an open cut without retaining walls. The arrangement of two tracks in the cut will be left unchanged for the present as far south as Church avenue, about one-half mile beyond this station, where the heavy work begins.

From Church avenue south the old line, the Brighton Beach Railroad and later the trolley line, ran on the surface. It is now being depressed in a four-track cut with heavy concrete retaining walls as far as Fiske terrace, just beyond which it crosses the Bay Ridge line of the Long Island Railroad, which is also being depressed as part of the New York Connecting Railroad improvement. Formerly the trolley line crossed the steam road under grade but the relative position is to be changed, the Brighton Beach tracks coming up to grade at this point and running on a fill beyond. This fill, which will be wide enough for four tracks and from 16 to 25 ft. high, extends to Sheepshead bay, about 3½ miles. All road crossings will be undergrade. The Manhattan Beach line of the Long Island Railroad, from Fiske terrace, south, is to be relocated parallel to the Brighton Beach line and on an extension of the same earth fill.

Express stations on the new line will be at Foster avenue, Kings highway and Sheepshead bay. At the street level these are being built of vitrified brick finished with ornamental tile and will have stairways leading up to island platforms above. All of the stations are being designed so as to collect fares from passengers before entering the trains instead of collecting on the trains as at present. Third-rail operation will eventually be installed in place of overhead trolley. This Brighton Beach improvement is heavier work than much of the reconstruction which steam railroads have to make, yet the Brooklyn Rapid Transit Company cannot charge anything like the steam road rates for its long distance travel and even has to fight to charge 10 cents to Coney Island, which is 11½ miles by the shortest of the B. R. T.'s lines from New York. When the improvement is completed the express running time over the Brighton Beach line will be reduced to 28 minutes.

The next largest item of expense under the general heading of track and structures is the rebuilding of the Canarsie Railroad, formerly the Brooklyn & Rockaway Beach, a steam dummy railroad from Atlantic avenue, East New York, to Canarsie Landing, three miles. This was rebuilt last year, one mile of the line in Vesta avenue having been placed on a steel double-track elevated structure which connects with the Fulton street line at Eastern Parkway, East New York. The right-of-way of the Brooklyn & Rockaway Beach on Vesta avenue is side by side with the right-of-way of the Long Island's Bay Ridge line, which is being rebuilt in connection with the extensive terminal improvements of that road in Brooklyn and Long Island City. The Long Island line will be depressed and the street raised, but the new elevated road has been built high enough so that there will still be head room. The steel pillars of the elevated structure rest on concrete foundations which will form part of the retaining wall on one side of the Long Island's depressed tracks. The construction and reconstruction of this line cost $363,000.

The Myrtle avenue elevated line used to end at Ridgewood. From this point the Bushwick steam dummy railroad, about one

mile long, ran to the Lutheran cemetery. This was another of the steam roads bought by the Brooklyn Rapid Transit. It has been connected with the Myrtle avenue line by an incline at Ridgewood. The elevated trains now run through to the Lutheran cemetery, the terminus being at Metropolitan avenue in the borough of Queens. At Fresh Pond road, as already mentioned, a storage and inspection yard holding 150 cars is being built. The cost of these improvements up to the end of 1906 was $276,000.

Various other surface lines have been reconstructed and extended and other improvements made at a total cost of $950,000.

With the exception of the Fifth avenue elevated line, most of the elevated structures were in bad condition in 1902. More than $500,000 has been spent to date in rebuilding and repainting them. The old latticed truss cross girders have been replaced by heavy plate girders and the stringers reinforced. In some places this was done with great difficulty owing to the limited space between the structure and the buildings, which prevented insertion of the cross girders in one piece. Where this condition existed, the girders were cut in two at the center, erected in halves and riveted together in place. The entire structure has been bonded for return power circuits at a cost of $42,000. Hand railings have been built along the foot walks. Many of the station platforms had to be lengthened to accommodate the six-car trains introduced with electric operation, and this item alone amounted to over $70,000.

On the surface lines, large amounts have been expended each year in repairing and improving tracks. In one year alone 75 miles of track were electrically welded to prevent leakage of return current and in four years $750,000 was spent for paving between tracks and repairs to pavements made necessary by changes and repairs to tracks, special work, etc.

The interlocking plants have all been thoroughly overhauled and 15 new ones installed. Most of these are mechanical plants, but those at Cypress Hills and East New York are modern electro-pneumatic plants, while that at Thirty-sixth street and Fifth avenue is all-electric. The total cost of these improvements and additions was $155,000.

With the change from steam to electricity on the elevated lines and the enormous increases in surface traffic the company has with difficulty kept pace with the demand for power. In 1901 it operated its surface lines with approximately 30,000 h.p., at times buying extra current from some of the lighting companies. It had six power houses, the three largest being at Kent avenue and Division avenue in Williamsburgh, at Third avenue and Fourth street, and at the foot of Thirty-eighth street. These plants generated direct current with reciprocating engines which was distributed at 600 to 650 volts over wide areas with consequent large transmission losses. Before the elevated lines were changed to electric operation, contracts were let for the construction of a new Central power house adjoining the old Third avenue plant. Plans were made for installing eight 4,000-h.p. reciprocating units which generate alternating current at 6,600 volts and distribute it to six sub-stations, where it is converted into direct-current at 500 volts. This plant was completed and put into full operation in 1904 and approximately doubled the company's available power. Before it was finished, however, an additional 4,000-h.p. unit was added to the Eastern power station in Williamsburgh, and plans were made to build an entirely new station adjoining that plant in which high-tension alternating-current generators with a capacity of 112,500 h.p. were ultimately to be installed. Work was begun on the first section of the addition early in 1904 and $2,200,000 has already been spent.

The new Williamsburgh station when completed will be the largest electric generating station in the world. It will have an overload capacity of 150,000 h.p., or 30,000 h.p. more than the present total requirements of the Brooklyn Rapid Transit Company during the hours of heaviest travel. The completed part of the new station contains one 7,500-h.p. and three 10,000-h.p. direct-connected horizontal turbine units generating high tension alternating current. The arrangement of coal handling machinery, coal storage, boiler rooms and all accessory apparatus is in accordance with the most modern practice. Coal is delivered in barges alongside a hoisting tower 135 ft. high. Clam shell bucket hoists raise it to feed pockets over crushers through which it is delivered to bucket conveyors and carried up to the top of the tower, thence across to the top floor of the boiler house and dumped in storage pockets. Two hoists each with a capacity of 100 tons an hour have been installed. The 72 water tube boilers which are to be installed are arranged in 18 batteries of four boilers each on each of the two floors. Only 34 boilers are now in commision. They are hand fired, coal being delivered by gravity to the floor in front of the fire doors from storage pockets above. Ashes are removed in metal dump cars handled by an electric locomotive running on an industrial track and are dumped into a conveyor which discharges them into reinforced concrete cinder pockets built in the hoisting tower. They can be dumped from here into barges alongside or into the company's ash-collection cars. Boiler feed-water is obtained from the city mains and from wells sunk nearby; condenser water is drawn through an intake tunnel from the river. All high tension switches, bus bars and feeder connections are built in fireproof brick niches on the gallery floor overlooking the generator room and the main switchboard and instrument panels are also on this floor. In the addition now under construction there will ultimately be installed four 15,000-h.p. turbine units. There is room in the present building for one more 15,000-h.p. unit, which has been contracted for.

The system of distributing current from the power houses has been entirely rearranged. All feeders, both high and low tension, leading to substations and other points have been, with few exceptions, removed from overhead pole lines and laid in underground conduits. A complete system of negative return feeder cables has been put in to save power losses. This work alone has cost nearly $2,000,000. Fifteen new substations have been or are being built at a cost of $1,260,000. Twelve of these are already in operation. They are in general of similar construction, of brick or reinforced concrete, one story and basement. The oil switches and feeder connections are in the basement and the transformers, rotary converters and switchboard on the ground floor. The high-tension current at 6,600 volts is stepped down through air-cooled transformers to 300 volts and fed to rotary converters which deliver direct-current at 550 to 600 volts. The converters are all 1,000-k.w. capacity. The largest stations are designed to contain six such units. The total amount spent for new power equipment and improvements during the four years ended with 1906 is about $8,250,000, and when the Williamsburgh station is finished the amount will be $11,500,000. The company is now in a position to meet the demands of the future for power for some time to come, even allowing for an excessively large increase over present requirements.

The evidence of the far reaching policy of improvement adopted by the company most visible to the traveling public is the condition of the rolling stock. More than $10,000,000 has been spent in four years for new elevated and surface equipment and in rebuilding old steam equipment, in addition to heavy annual expenses for maintenance of equipment in service. On the elevated lines 628 old steam cars were rebuilt, wired and the motor cars equipped with multiple unit control and motor trucks. When turned out of the shops these cars were practically new. The motor cars were equipped with two 150-h.p. motors each, and all cars had automatic air-brakes applied. For new equipment the company adopted a standard design of convertible motor cars with steel underframes and metal sheathed sides. These cars seat 60 passengers, have a center aisle and reversible seats and are quickly converted from open cars to closed winter cars with suitable heating arrangements. There have been bought and placed in service 320 new cars of this general type.

For the surface lines 650 new double truck motor cars have been bought. The newest cars are large and modern in every respect. They have steel underframes and sides, are convertible for summer and winter service and will seat 48 passengers. They are mounted on high-speed trucks carrying four 40-h.p. motors and are fitted with air-brakes. With a total of 3,454 cars available for service the company operates an average of 2,021 cars a day.

The following is a summary of the principal expenditures charged to capital account between October, 1902, and December, 1906:

Shops, car barns and terminals	$1,808,500
Power houses and power equipment	8,122,000
Tracks and structures	4,763,500
Rolling stock	10,300,000
Right of way	8,000,000
	$25,804,000

Of this sum $7,450,000 was spent in 1906. About the same amount will be spent in 1907 on improvements planned or under way.

With the consolidation of the various surface and elevated lines there have come large extensions of the transfer privilege. One cause of the great crowding of the Brooklyn Bridge in the rush hours is that passengers from points outlying from terminal and junction points on the elevated lines such as Thirty-sixth street, Fifth avenue and Ridgewood can come to those points by trolley and transfer without paying another fare to the elevated lines, which lead directly across the Brooklyn Bridge to New York. Thus thousands of people can live remote from the city and the through lines and yet have the use of the elevated lines as cheaply as those who use them direct. Last year also the transfer privilege between surface lines was greatly extended by issuing in most cases a transfer on a transfer as long as desired, so that it is generally possible to go from any point on the surface lines to any other point.* These are instances where the company has granted unusually favorable concessions to the public. The first has resulted in a great deal of extra traffic over the already heavily burdened Brooklyn Bridge (in 1882, the first year the bridge was open for traffic, 8,000,000 passengers were carried on the shuttle trains as against 150,000,000 on trains and surface cars last year), and the second in great abuse of the transfer privilege by passengers. Immediately following the extension of the transfer privilege on the surface cars, the number of passengers carried and the number

*This, of course, does not apply to the lines owned by the Coney Island & Brooklyn Railroad, which is not owned by the Brooklyn Rapid Transit Co., and which operates the DeKalb avenue, Smith street and Franklin avenue lines, the last two of which go to Coney Island.

of car miles run considerably increased, while gross earnings fell off sharply and have continued to do so since. A new system was put in operation on May 9 under which a passenger is limited to two, or in the case of "feeder" lines like the short Montague street cable line, which runs from the Borough Hall to the Wall street ferry, on which continuing trip tickets are issued, three transfers. A white transfer is issued for a continuing trip from a feeder line and also in emergencies. In all other cases a yellow transfer is issued for a cash fare and a green transfer for a yellow transfer. The holder of a green transfer is not entitled to another transfer. On the green transfer the name of the line which originally issued the yellow transfer for which it is given in exchange, is punched, to prevent the passenger from transferring back to the line on which he first rode. Although the company is anxious to be as liberal as possible in this relation to the public, the transfer system has been so grossly abused that this limitation is necessary. With unlimited transfers given for the asking there has been a regular exchange of transfers between employees of many of the large department stores and factories in spite of the State law prohibiting the sale or exchange of a transfer by the original holder. More than this, many people found it possible to secure what amounted to a round trip for a single fare. Like all problems which the company has to face where the public is immediately concerned, this is a difficult one.

A future measure of relief for the great congestion of surface cars on Fulton street during both the morning and evening rush hours lies in the law enacted by the Legislature during the present session providing for the adjustment of the cost of widening Livingston street, which parallels Fulton street for about a mile. This is to be paid by the whole city of New York on the ground that the diversion of traffic through that street, thus relieving the great delays on Fulton street, will be of benefit to the city as a whole. The franchise for this parallel route is pending, and if granted the company is to at once build the new line. As indicating the difficulty of carrying out any plan which involves the consent of the city, the Brooklyn Rapid Transit has for two years been trying to get this permission to occupy the street in order to relieve conditions which daily cause immense inconveniences to the traveling public.

Directly connected with the Livingston street improvement is a fresh problem of great importance with which the company is now face to face. The subway from the Battery, Manhattan, to Brooklyn is to be in operation before the end of the year. Anyone who stands in the Brooklyn Bridge station of the New York subway during the rush hour can get an idea of the very large number of people who, instead of crossing the Brooklyn Bridge, as they do now, will continue on the subway to the Battery, and thence go under the river to Brooklyn. This subway is to run only as far as Fulton street and Flatbush avenue, about half a mile beyond the Borough Hall. The first station is to be at the Borough Hall, and here most of the passengers will leave the subway to take different surface lines which center there. This is, of course, some of the most valuable land in Brooklyn, much of it belonging to the city, yet some arrangement must be made by the Brooklyn Rapid Transit for a station to handle the immense crowds which will leave the subway at this point to take the surface lines. Plans for this station are under consideration but no definite decision has been reached.

In 1906 367,567,567 cash passengers and 126,924,245 transfer passengers were carried, a total of 494,491,812 for the year. An average of 2,021 cars are operated daily on 488 miles of surface track and 69 miles of elevated track, a total of 557 miles (including first track, second track and sidings), yet in a single day more passengers are carried on this 260 miles of line (231.5 miles on city streets, old steam railroad rights of way and East river bridges and 28.5 miles on elevated structures) than on the thousands of miles of line of all the railroads west of the Mississippi combined. This gives a hint of the tremendous problems which the company must meet.

The work outlined above which has been going on for the last four years has accomplished much, but the rehabilitation is not yet entirely finished and cannot be for some years to come. The large and steady growth in the outlying districts of Brooklyn and Queens alone will require each year corresponding expansion of transit facilities. In the end, however, the Brooklyn Rapid Transit will undoubtedly reap the benefit of increased earnings, which are already beginning to show. Some of its most serious problems cannot be avoided. The geographical limitations to expansion in the congested business district, the heavy summer traffic to seaside resorts—which requires an enormous outlay in plant, bringing in little or no return during half the year—and the rush hour traffic at night and morning to and from Manhattan Island are difficulties which are inherent to the system. On the other hand, within the next few years better arrangements will undoubtedly be made for collecting and distributing through traffic at the Manhattan terminals of the two bridges now completed and the third bridge soon to be begun. This is the crux of the whole situation. Not until all the parties in interest, the city, the citizens and the company, resolutely co-operate in carrying through with all speed the long delayed plans for a comprehensive scheme of bridge terminals and connections in Manhattan, can the Brooklyn Rapid Transit best serve the interests of both its patrons and its owners.

Railway Signal Association.

The May meeting of the Railway Signal Association was held in New York City on Tuesday of this week, Vice-President A. H. Rudd in the chair. About 100 members were present. The meeting place has been changed to the spacious and elegant hall of the American Society of Civil Engineers, in the society's building at 220 West 57th street.

The first discussion was on a progress report of Committee No. 15. This committee has taken the specifications for mechanical interlocking, which were adopted last year, and made such additions and changes as were thought necessary to adapt them for drawbridge interlocking. The meeting spent an hour or more on the various details. The principal paragraphs on which definite action was taken were Nos. 29, 48, 49, 71 and 180. No. 29, "a separate lever must be provided for each set of locks," was referred back to the committee because the meeting was at sea as to the meaning of the word "set." No one knew whether it meant the locks for one track or two or more tracks. Paragraph 48, prescribing the use of pipe lines for all connections except distant signals, was discussed at length, and finally it was voted to recommend to the committee that pipe lines be used for connections to switches and locks within 700 ft. of the cabin and to signals within 1,200 ft. of the cabin; the understanding being that switches and signals at distances greater than those here specified should be worked by power and not manually. This motion was carried by a vote of 19 to 12.

Paragraph 49 was referred back to the committee with the recommendation that the committee consider specifications for the weight and composition of pipe for interlocking connections. There was some discussion as to the desirability of using parallel or tapered threads in pipe couplings. No definite recommendations were referred to the committee. The committee was also instructed to report on specifications for signal posts and foundations, which do not form a part of these specifications. In accordance with the recommendation of the committee the meeting approved the reinsertion of paragraph 71, requiring cranks with arms 11¾ in. long. At the Washington meeting this paragraph was stricken out, and it is now proposed to reinsert it. Paragraph 84 was amended by striking out the word "separately," so that it reads, "Compensation shall be provided for each pipe line," and was adopted with the amendment. Paragraph 180, which proposed a method of mounting compensators, pipe carriers and other parts on a continuous timber fastened at the center of the draw span, and running the full length of the structure, was rejected. The object of the proposed construction was to overcome the difficulty due to the unequal expansion in the bridge structure and in the pipe lines. As none of the members had ever tried such construction it was deemed inadvisable to embody it in the standard specifications.

A paper on "How to Reclaim Storage Batteries After Having Been Improperly Used," by Mr. J. E. Hackman, Supervisor of Signals, Lehigh Valley, was the next subject considered. The author described the methods to be employed in restoring to their normal condition storage batteries which have been repeatedly overdischarged and the plates badly sulphated. The method described was used by the author in reclaiming two well-known types of batteries, and the results were very satisfactory. Following the reading of the paper, Mr. L. H. Flanders, of the storage battery department of the Westinghouse Machine Company, gave a short talk on some of the principal difficulties encountered in maintaining storage batteries, the methods to be employed in testing for failures and in remedying some of the most common defects. The morning session adjourned at 1 o'clock.

The first thing in the afternoon was the reading of a paper by Mr. Byron E. Eldred on copper-clad steel wire for electric purposes. Mr. Eldred gave a description of the "Monnot wire," recently invented by J. Ferreol Monnot. This substance is made from billets which have a steel center, with a copper coating. In a billet of say 4 in. diameter, one-tenth, more or less, will be copper, the steel being in the center. This billet is drawn down to make a wire of any desired diameter without causing any trace of separation between the two metals, and while still maintaining the copper coating at a uniform thickness throughout the circumference of the wire. Copper-clad steel billets have been heated with a blow pipe to such an extent that the copper began to melt, and then chilled by immersion in ice water, yet the weld was not weakened. Attempts to separate the two metals in a billet by the use of a cold chisel cause breaks either in the steel or in the copper, but do not weaken the weld. The weld between the two metals is such that when strains are produced in the copper by reason of the difference in the rate of expansion of the two metals under heat, they appear to cause expansion at right angles to the axis of the wire or

rod. The steel appears to take up the longitudinal strains without appreciable deformation.

Figures were given showing the saving in cost of a copper and steel wire, as compared with a pure copper wire, when used for the same electrical purposes. The Westinghouse Machine Company uses copper-clad steel for turbine blading. Summing up the advantages of the new wire as regards greater tensile strength than copper, equally satisfactory conductivity and freedom from corrosion the author says:

It is considered good practice by signal engineers to use No. 10 B. & S. gage copper for overhead construction, either bare or in double or triple braid, while in five and seven pair cable No. 14 B. & S. gage copper is considered the standard of practice. It would thus appear that the conductivity of No. 14 B. & S. gage copper satisfies the electrical requirements while the tensile strength of a No. 10 B. & S. wire is desired. In other words the erection of No. 10 B. & S. copper lines in overhead construction necessitates the use of 32 lbs. of copper for each 1,000 ft. to secure required tensile strength. At present prices the copper for such a line costs $8.77 per 1,000 ft. Consider a No. 11 B. & S., 50 per cent, conductivity (Grade "C") copper-clad wire to displace the No. 10 pure copper. The No. 11 copper-clad wire affords the required conductivity while its breaking weight is greater by 156 lbs. The weight per 1,000 ft. is less by 8.7 lbs., and safety factor is greater. The cost per 1,000 ft. of such a high conductivity copper-clad wire would be $6.78, showing a saving in metal cost alone of $1.99 per 1,000 ft. in favor of the copper-clad wire, not to mention the other attendant advantages in cost of stringing a lighter, stronger, more durable wire, allowing of much longer spans.

In most instances signal engineers will probably prefer to use Grade "A," 30 per cent. conductivity, copper-clad wire, having greater electrical resistance but allowing of the use of a much smaller conductor of higher tensile strength. Where possible to make such applications of copper-clad wire, a No. 13 B. & S. gage Grade "A" wire with electrical resistance at 60 deg. F., of 6.543 ohms and breaking weight of 488 lbs., affords a considerably greater safety factor than No. 10 B. & S. gage copper. Such a copper-clad wire weighs but 14 lbs. per 1,000 ft. and costs less per pound than Grade "C," so that to-day's prices per 1,000 ft. would be $3.44, or a saving over No. 10 B. & S. gage copper of $5.58 per 1,000 ft., or a metal cost saving over pure copper now used in open-line construction of nearly 60 per cent.

Defective Rails.

The rails furnished by the steel companies in this country have become so bad within the last five years, especially rails of 100-lb. and other heavy sections, that the American Railway Association is now investigating the matter, and proposes to ask the United States Steel Corporation to furnish specifications of chemical composition and manufacture, and then adhere to those specifications. We have collected a number of letters bearing on this subject from railroad officers, whose names we are not at liberty to disclose, and print extracts from them herewith. We also show the radical results found in the recent investigation by the New York Railroad Commission. It will be observed that 495 rails of 100-lb. section were broken and removed from the main line of the Lake Shore & Michigan Southern in New York State during the first three months of the current year, out of a total of 505 rails broken. Also that 475 100-lb. rails broke on the New York Central main lines east in New York within the same period, out of a total breakage of 477 rails. On the main line of the Mohawk division, 217 100-lb. rails broke in three months; on the western main lines (within New York State) 107 100-lb. rails broke. The total number of 100-lb. rails broken within the state in January, February and March was 1,295; a disgraceful record, for which the Steel Corporation is mainly responsible, as proved by the much lesser breakage of older rails, rolled according to specification. As pointed out in the editorial column, the companies have been unable to insist on their specifications since 1901, but have been forced to take what was given them. The kind of rails they receive are shown in the accompanying photographs.

Letters from railroad officers follow:

I regret to say that the records of our maintenance of way department have not, until quite recently, been kept in such shape as to render statistics on the question of the breakage of rails accurate or reliable, and consequently in speaking of this matter, I can only give you impressions and not substantiated facts. These impressions, however, are confirmed to a very large extent by conversations with the officers of other railroads, who, as a general rule, agreed that the breakages of steel rails during the last four or five years have become much more numerous than formerly, and may be properly described as excessive.

I do not think these breakages can be ascribed to any one cause, but rather to the cumulative effect of a number of causes acting together. Prominent among these, perhaps, is the modern tendency to insist upon constantly increasing the output of tonnage from a given plant. This involves, of course, higher speed being attained in the various processes of manufacture. This means, of course, that less time is consumed in the transformation of the steel from the ingot to the bloom and from the bloom to the rail, which is practically now one continuous process, where it used to consist of two or three separate processes. It also has the effect of increasing considerably the temperature at which the metal is worked, and this in turn is apt to produce somewhat less dense and homogeneous product. Forging steel at temperatures over red heat, as well known to steel experts, is ineffective.

Another cause which tends to help along these same results is the increase in the size and weight of the rail sections. It is manifest that in starting from the ingot or bloom of a given size less time and less pressure, or, in other words, less work upon the metal, is necessary to produce a section weighing 90 lbs. or 100 lbs. per yard than would be required to produce a section weighing 50 lbs. or 60 lbs. per yard, and in this way also the density and solidity of the metal in the finished rail is apt to be less in the heavier section which we are using to-day than in the lighter section used years ago. I believe that the section of the heavier rail is just as safe as the lighter section in relation to the loads carried, provided the density of the metal is the same in both cases, and I do not think the section of the heavier rails *per se* is at fault.

It has been found that a considerable number of the breakages are due to what is technically known as "piped" rails.

This is a hidden defect which it is impossible to detect by the most careful surface inspection, and I believe can be attributed largely to the desire on the part of manufacturers for increased tonnage product. The process of casting the ingots from which rails are finally made, results necessarily in the upper portion of the ingot being more or less defective by reason of the contraction cavity and the occluded gases contained in small pockets on account of the molten metal being poured into the mould more rapidly than the gases can escape. This is common to all forms of steel castings, and it can be overcome by cutting off and discarding the

Rails Broken and Taken from Track During January, February and March, 1905, 1906 and 1907, in New York State.

Compiled by New York State Railroad Commissioners.

Name of Railroad	Division	1905 Weight of Rail per Yard: 58	58	60	65	67	70	72	75	76	80	85	90	100	Total	Total Tons	1906 Weight of Rail per Yard: 50	56	58	60	65	67	72	74	75	76	80	85	90	95	100	Total	Total Tons	1907 Weight of Rail per Yard: 56	58	60	65	67	70	72	75	76	78	79	80	85	90	95	100	Total	Total Tons
Delaware & Hudson	Susquehanna										36				36												32					32																	64	
" "	Saratoga										12				12												9					9																	3	
" "	Champlain										12				12	60											19					19	60																	26	93
Lehigh Valley	Main Line		1								73		24½		101												33		10⁴			33			1	1										32	38½		72	
" "	Branches	2	6	10		1				2	3				24	125	3	4	3						2	5						17	50	10	4	1					3			13					31	103
Rutland	O. & L.C.							1	1		8				10							2		1	4						7							1					6					7	
"	Chatham														0	10																0	7	11		2													13	20
N.Y.N.H.&H.							3		7						10	10							1							1	2	2						1		26	1						1	29	29
Boston & Maine	Main Line							3		10		3			16										2		5				7																	5	
" "	Branches		6					10		2					18	34																0	7															0	5
Buffalo, Roch. & Pitts.	Rochester										13				13												3					3													13		119		132	
" " "	Buffalo										13		1		14	27											1					1	4														124		124	256
N.Y. Ont. & West'n	Main Line	Unable to furnish information																								13				4	17														4		4	8	
" " "	Branches			"	"	"				"							3	1			3										7	24	2															2	10
Penn. (B.B.&A.V. Div.)	Chautauqua				84	3						1			90						126						3				129													92	4		9		105	
" "	Buffalo														0												1	16				17														3	61		64	
" "	Rochester Branch	16			33						1				50	140	4		3		21						12					40	186	10											19			5	2		36	205
Lake Shore Ry.	Main Line			5							222				227	227				2							16			16	34	34			4													0		495	505	505
N.Y.C. & H.R.R.R.	Main Line East										5			199	204												3			65	68																	2		475	477	
" "	" " Mohawk										109				109												108			8	116																	121		217	338	
" "	" " Western										71				71												56			7	63																	57		107	164	
" "	Branches Eastern		1								2				3					2							2				4				6	2													5			13	
" "	" Mohawk					16			6		11				33								1				4				5						18		7										112			137	
" "	" Western			2	6										8					3							3				6				3	8													12			23	
" "	" R.W.&O.		9			9					4				22				8	11							2				21			8		1	16													37			82	
" "	" River Div.										14				14												5				5	288				1													27			28	
" "	" Penn. "							2			3				5	469																							1											1			2	214
Erie	Main Line New York Delaware	No Record											4		4														15		15																		23			23	
"	" " Susquehanna										29		26		55														12		12																	34		113	136	
"	" " Allegheny																												18		18																			15	15	
"	" " Buffalo										1				2												7				7																			4		11	
"	Branch Line Rochester	No Record							1⁷⁶												45⁹⁰											45				85⁶⁰													8⁷⁶			90	
"	" Greenwood Lake																																																			
"	" Goshen & Calicoon																																																			
"	" Unit & Tri Pattern																																																			
"	" Meadville Division								9⁷⁶				5		5	76													5		5	142																		2		2	429	
	Total	18	7	28	7	142	15	14	28	14	642	4	64	199		178	3	8	4	14	63	150	2	1	2	17	315	24	109	4	97		804	33	5	18	93	139	20	1	17	9	28	1	490	75	675	4	295		2899

upper end of the ingot before rolling it into rails. This necessarily involves the wasting of a considerable amount of material, and I think it is very likely that in order to increase the tonnage and decrease the cost of production, the mills are discarding less of this metal than formerly, with the result that a larger per cent. of the finished product contains these defects, which it is impossible to detect until the rails have been subjected to considerable service, and which has the effect of eventually producing a broken rail.

From what I have said above, I think it will be apparent that an increase in the section of the rail is not likely to cure the difficulty, nor is it necessary as a measure of safety, nor do I believe that the chemical composition of the steel from which rails are made is subject to just criticism.

There are some measures which I believe could be adopted by the rolling mills which would improve the quality of their product:

First: A somewhat slower manipulation of the metal, resulting in the finishing of the rails at a lower temperature than is common at present, and to that extent increasing the amount of work or pressure which is applied to the metal, and consequently increasing its density and solidity.

Second: The discarding of a somewhat larger percentage of metal from the original ingot, which would have the effect of lessening the liability of hidden defects in the finished product.

This whole matter was gone into very carefully in two papers which I wrote a number of years ago. While I was a good deal less experienced as a railroad man then than I am now, I was fresh from a very close study of the methods of manufacture, which have not materially changed in respect to rails in the last fifteen or eighteen years. The conditions which I cited as bad when I wrote the papers I refer to have grown somewhat more accentuated, and because a heavier weight of rail is being used, there is actually less mechanical work being done on the steel than formerly.

—PRESIDENT.

We have had more or less broken rail this winter, but we did not seem to have as serious a time as some of the other roads. We have taken no steps to try to get different rail because the steel companies have been unwilling to change specifications, and the railroad companies have been obliged to take the rail as furnished by the steel companies or not get it.

My own notion is that the breakages are due to two principal causes: First, that the demand on the steel companies for rail is so great that there is not the same care used to-day in making the rail that there used to be ten or twenty years ago; second, that the volume of business passing over the railroads has been so great in the last eighteen months that in spots the track is not as good as it used to be, due to this volume of business and to scarcity of common labor, and the poor quality of common labor.

As you know, many of the railroads throughout the country are overtaxed as to business, and the result of that is a strain on all departments, which increases the danger of poor work and risk of accident.

—PRESIDENT.

Your letter of April 6. I should say the quality of the rails furnished is gradually getting worse and the axle load of engines and their speed is gradually increasing. Under these conditions it does not seem surprising to me that the roads should have many broken rails. On our road we are not having any trouble, because we have stopped at a 45,000-lb. axle load and a moderate speed.

—VICE-PRESIDENT.

Personally, I think a good deal of the trouble with the wearing qualities of the present rails is due to a process of manufacture so rapid that the metal never cools and the minimum amount of work placed on them until they are turned into finished sections, and think that with concerted action on the part of the railroads and in conjunction with the rail manufacturers that the rail specifications should be made to govern the process of manufacture so as to accomplish a tougher rail and one that is free from pipes. We get rails that stand our specified drop tests and that are in composition according to our specification, but we do not get the wearing properties we should. It has also become a question in connection with the larger rail sections and the heavier loads whether the time has not arrived when the section of the A. S. C. E. should not be revised so as to distribute the thickness of the flange, web and head to be more uniformly the same throughout so that the heating and cooling would also be more uniform. I believe that the open hearth process is the one that should be generally adopted in the United States as rapidly as possible on account of the possibilities of reducing the phosphorus and sulphur.

—RESIDENT ENGINEER.

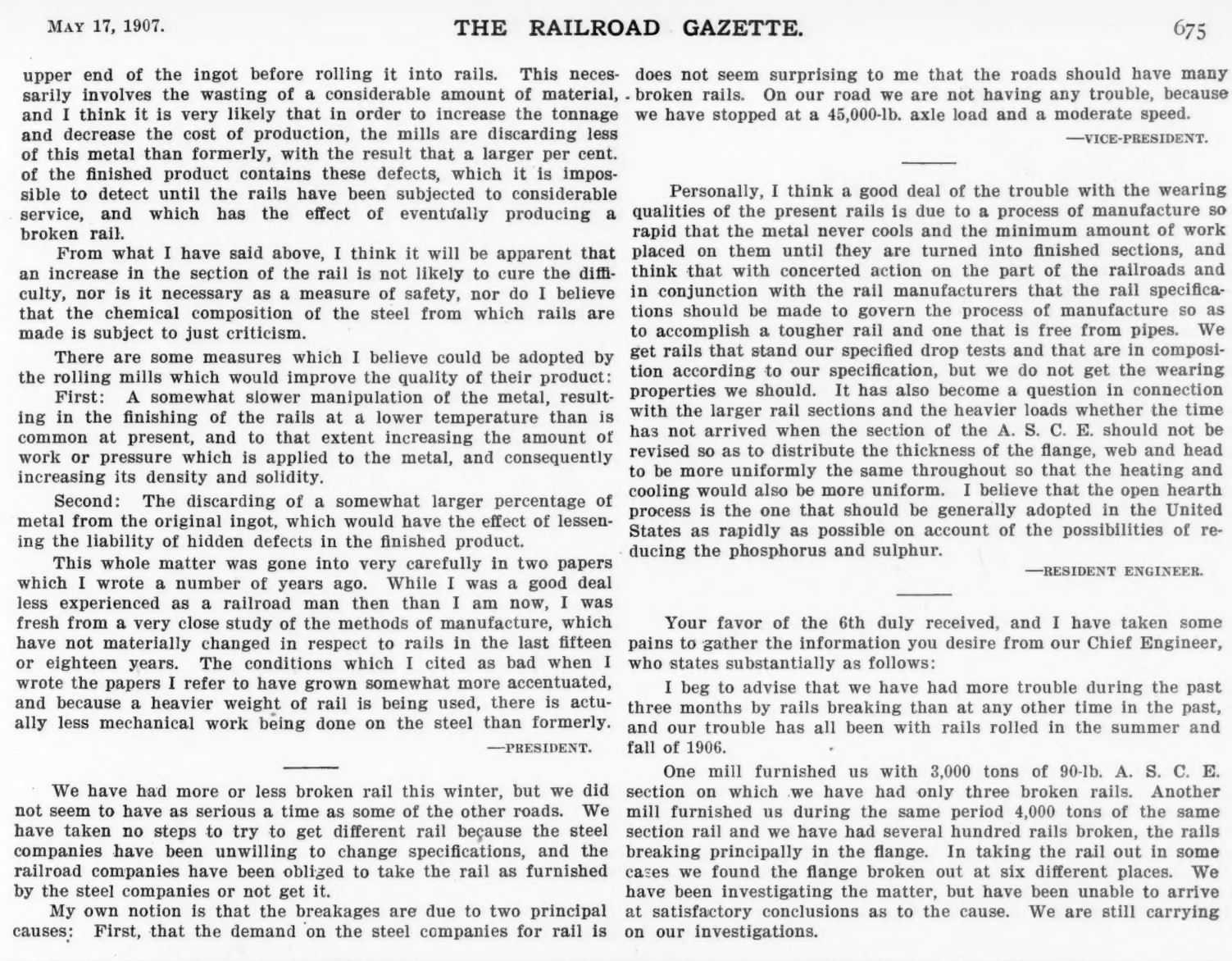
Your favor of the 6th duly received, and I have taken some pains to gather the information you desire from our Chief Engineer, who states substantially as follows:

I beg to advise that we have had more trouble during the past three months by rails breaking than at any other time in the past, and our trouble has all been with rails rolled in the summer and fall of 1906.

One mill furnished us with 3,000 tons of 90-lb. A. S. C. E. section on which we have had only three broken rails. Another mill furnished us during the same period 4,000 tons of the same section rail and we have had several hundred rails broken, the rails breaking principally in the flange. In taking the rail out in some cases we found the flange broken out at six different places. We have been investigating the matter, but have been unable to arrive at satisfactory conclusions as to the cause. We are still carrying on our investigations.

We are of the opinion that these breakages are not caused on account of the loads to which these rails have been subjected being carried to extremes. We have used this same rail section and same class of power with 50-ton steel cars for the past three years and have had but few rails break until the past three months of rails received last summer and fall. We are of the opinion that the trouble lies with the class of Lake Superior ore that is now being used in the manufacture of Bessemer steel for rails, there being too much phosphorus in the same, as by using the Bessemer process too much phosphorus is left in the steel. From indications the rails have been too severely gagged in straightening at the mills.

The principal railroads in this neighborhood have had the same trouble with last year's rolling of rails. Increasing the section I do not think would remedy it, as we have had 60 miles of 100-lb.



Rails Broken and Taken from Track During January, Ferbuary and March, 1905, 1906 and 1907, in New York State.

Compiled by New York State Railroad Commissioners.

Fig. 1.

Fig. 2.

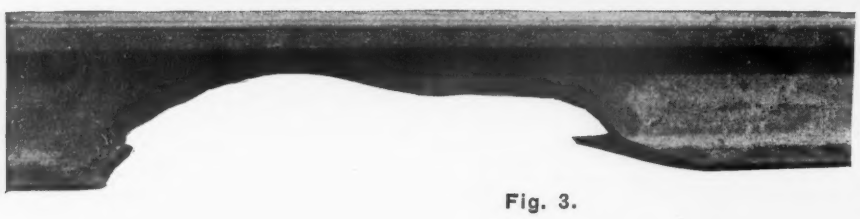


Fig. 3.

Fig. 4.
Defective 100-lb. Rails.

Fig. 5.

Fig. 6.

Fig. 7.

Fig. 8.

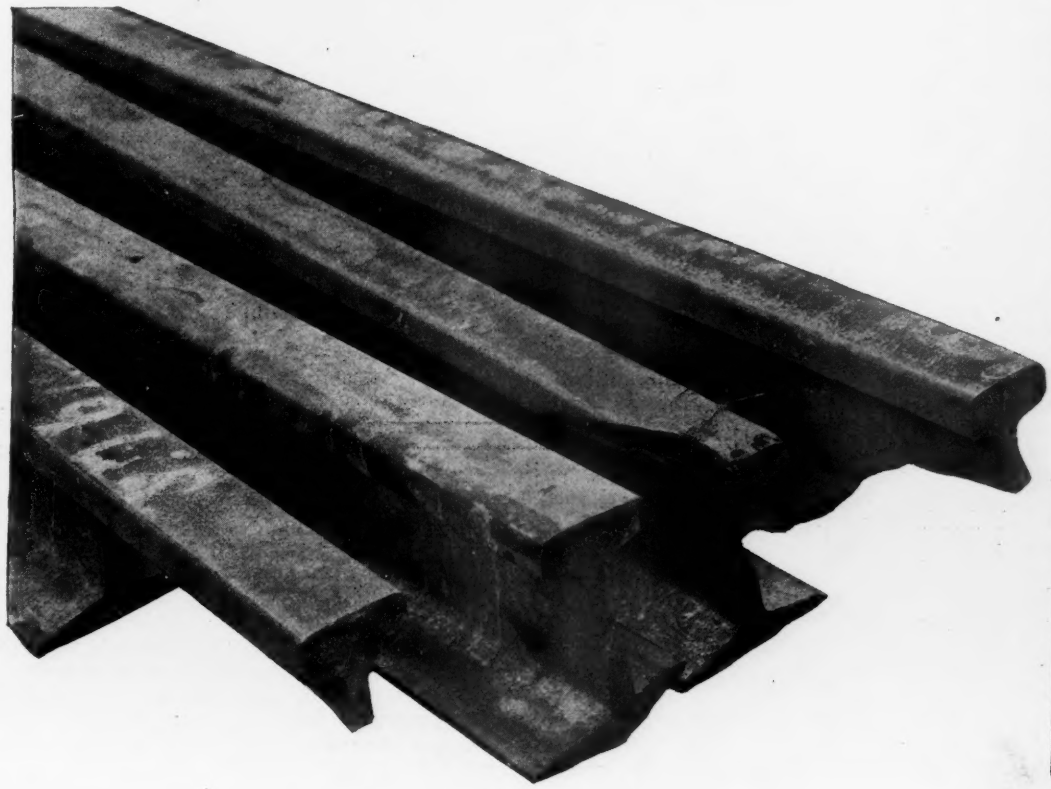


Fig. 9.

Fig. 10.

Defective 100-lb. Rails.

steel, rolled in 1898, which is to-day in the track and giving good service and on which we have very few broken rails.

—PRESIDENT.

Referring to your communication of April 13 in regard to breakages of steel rails:

I attach for your information a memo. showing our record of broken rails during 1906. This statement shows weight of the rail, temperature at time of break, and the date it was laid.

Our greatest trouble seems to be with the 90-lb. rail which was laid in 1898, 1899 and 1900, and the chemical analysis of this rail shows improper material used in the making of the rail.

We have had these matters up with the manufacturers, however, and naturally there is a dispute about it.

I hope this statement will be of use to you in reaching conclusions on this important matter.

—PRESIDENT.

RECORD OF BROKEN RAIL.

Main Line.

Date—1906.	Weight of rail.	Temperature at time of break.	Date laid.
Apr. 14	90 lbs.	.....	1898
May 1	90 "	.....	1900
July 17	90 "	80 above.	1898
July 21	100 "	.....	1903
Oct. 16	100 "	60 above.	1903
Dec. 4	80 "	40 "	1895
1907.			
Feb. 4	100 "	4 "	1900
" 4	100 "	4 "	1900
" 7	100 "	35 "	1905
" 8	100 "	.....	1902
" 8	100 "	.....	1903
" 8	100 "	.....	1902
" 17	100 "	.....	1902
Apr. 11	76 "	.....	1893
" 11	56 "	.....	1897
" 14	75 "	46 above.	1892

"A" Division.

1906.			
Apr. 30	90 lbs.	.....	1899
May 21	90 "	70 above.	1900
July 6	90 "	65 "	1900
" 6	90 "	65 "	1900
" 20	90 "	75 "	1905
Aug. 27	90 "	65 "	1900
Sept. 15	90 "	60 "	1900
" 19	90 "	75 "	1900
Oct. 16	90 "	60 "	1898
" 25	90 "	65 "	1900
" 27	90 "	65 "	1900
" 30	90 "	60 "	1902
Nov. 1	90 "	50 "	1900
" 2	90 "	60 "	1898
" 6	90 "	60 "	1900
Dec. 4	80 "	8 "	1893
" 4	90 "	10 "	1900
" 11	90 "	45 "	1900
1907.			
Jan. 6	90 "	50 "	1899
" 7	90 "	60 "	1899
Feb. 9	90 "	30 "	1900
" 9	90 "	30 "	1900
" 16	90 "	35 "	1900
" 20	90 "	40 "	1900
" 20	90 "	40 "	1900
" 23	90 "	25 "	1900
" 26	100 "	30 "	1901
" 27	90 "	40 "	1900
Mar. 5	90 "	35 "	1900
" 14	90 "	45 "	1900
" 16	90 "	55 "	1900
" 18	90 "	50 "	1905
" 19	62½ "	40 "	1895
" 19	62½ "	.....	1895
" 19	70 "	.....	....
" 19	56 "	.....	Old.
" 21	90 "	50 above.	1905
" 23	56 "	70 "	Old.
" 23	56 "	70 "	Old.
" 31	90 "	50 "	1899
Apr. 2	62½ "	.....	Old.
" 11	90 "	50 above.	1900

Main Line.

1906.			
Jun. 11	80 "	50 above.	1906

"A" Division.

1906.			
Jun. 5	100 lbs.	75 above.	1903
Nov. 2	90 "	55 "	1900
" 16	100 "	70 "	1903
Dec. 10	100 "	40 "	1903

"B" Division.

1906.			
Aug. 6	80 lbs.	88 above.	1905
Nov. 17	80 "	50 "	1905

"C" Branch.

1907.			
Feb. 8	80 lbs.	.....	1905.
" 23	80 "	.....	1905
Mar. 12	80 "	.....	1898
Apr. 4	80 "	45 above.	1905

"D" Branch.

1907.			
Mar. 1	80 lbs.	10 above.	4 days.
Apr. 11	80 "	50 "	1905

Miscellaneous.

1907.			
Mar. 19	56 "	.....	Old.
" 24	80 "	35 above.	12 hrs.
" 25	80 "	60 "	1906

Reference to our records discloses the following cases of broken rail occurring on this line during the year 1906:

On 190 miles of 60-lb. steel laid between 1890 and 1893, and 16 miles laid in 1898, there were 38 rails broken during the first six months of the year, thirty-two being in cold weather and six in warm weather.

On 38 miles of 75-lb. rail laid in 1899 there were 45 rails broken during the year. Twelve of these were broken in warm weather and thirty-two in cold weather, and one on account of having been kinked by fire.

On 70 miles of 80-lb. rail laid between 1902 and 1905, there were seven rails broken during the year; one during cold weather and six during warm weather.

On 248 miles of 85-lb. rail laid during 1906, there were seventeen (17) rails broken during the year, five during cold weather and twelve during warm weather.

The above is summarized as follows:

Weight.		Age.	Broken rails, pr mile pr yr.
60-lb.	190 miles	15 years.	....
	16 "	9 "	0.37
75-lb.	38 "	7 "	1.18
80-lb.	70 "	1.5 "	0.10
85-lb.	248 "	6 mos.	0.20

Considering the number of years the 60-lb. rail has been laid, the broken rails per mile per year seems to average much less than in any of the heavier sections, disproving the theory that the rails are subjected to heavier tonnage than they can carry with safety, and would seem to give strength to the contention that the rails which are now being furnished are of an inferior quality compared with those rolled 12 or 15 years ago.

The cause of the inferior modern rail has been the subject of a great deal of discussion—two theories being advanced: one—which is generally accepted as correct—being that in the process of manufacture the rails leave the rolls at too high a temperature. The other theory is that interior strains are developed in the larger sections, which do not occur to as great an extent in the rolling of lighter rails.

Fig. 11—Defective 100-lb. Rail.

We are inclined to agree that the high temperature theory is the correct one. A number of the roads are endeavoring to limit the temperature of the rails as they leave the rolls, but I am without any definite knowledge as to in what degree this has been effectual in preventing breakages.

—PRESIDENT.

I beg to say that the experience of this company is that we have had more broken rails during the past winter than heretofore.

I am inclined to think that rails rolled during the last few years are not so good in quality as those rolled ten or more years ago. We have had breakages of rails made by many different manufacturers, and of many different dates or ages. Possibly a considerable part of the increased breakage is due to heavier traffic and greater proportion of heavy engines than heretofore. On one line

upon which heavier engines were placed about two years ago, the breakages were very numerous. Piped rails, which did not show up the defects under the lighter engines, were quickly discovered after the new and heavy engines were placed in service. Negotiations are pending for some change in specifications, but mills seem to be very averse to meeting the wishes of purchasers in this respect. —CHIEF ENGINEER.

We seem to be immune in a measure from the general complaint relative to broken rail. During the past season we had 148 90-lb. rails break on approximately 1,500 miles of track laid with this type of rail; only eleven of these rails were rolled in 1905 and 1906, the balance run from 1898 and so on up. The great majority of these breakages were due to flaws and a few of them, in my judgment, to improper care. As you probably know, our freight power is comparatively light, the maximum being 128,000 lbs. on the drivers.

We can scarcely hazard an opinion as to the underlying cause of the trouble on other lines, because we are not acquainted with the conditions and the difficulty on our own road is no greater this year than it has been for a long period of years with lighter rail.

—VICE-PRESIDENT.

There was an increase during 1906 in both the total of defective and broken rails removed from track, and in the number of defective and broken rails removed per 100 miles of track. The ratio of increase of defects and breakages in 100-lb. rail was greatly in excess of that of the 85-lb. rail.

Our engineers have been giving the question much investigation and consideration, but do not feel prepared at present to express their conclusions as to the underlying cause of the trouble. We understand the whole subject will be a matter of discussion at the coming meeting of the American Railway Association, when no doubt much additional light will be thrown on it.

—PRESIDENT.

Fig. 12—Defective 100-lb. Rail.

Our investigations in connection with rail failures indicate that the cause of 90 per cent. of the failures is due to mechanical defects or lines of weakness in the flange, which become apparent after the break occurs in the form of a slight fold in the base of the rail.

We are receiving rails from one mill in which 80-lb. rails pass through the rolls 28 times. The breakages in this class of rail are very much less than those of any other brand of 80-lb. rails, and the phosphorus in these rails does not exceed .085 per cent. and the carbon averages .57 per cent. to .59 per cent. This result leads us to think that the proper remedy for rail breakages is to reduce the phosphorus and other impurities and to give a larger number of passes through the rolls, with the carbon high enough to prevent the ends of the rails from flattening. —VICE-PRESIDENT.

We certainly have had the same experience as other roads, and have been troubled especially with defects in the ball of the rail appearing suddenly after the rail has been in service but a short time. In some cases these flaws are so bad that it is necessary to change the rail very promptly to avoid serious danger.

Our idea is that in the haste to increase product and the good market which has prevailed that the former care is not exercised and that the ends of blooms are not as conscientiously cut off as formerly, thus causing the piping in the interior of the rail, which develops under road conditions. —GENERAL MANAGER.

Our figures show, eliminating breakages that were due to the broken rail being practically worn out, we have had but 307 broken rails in the main tracks of our line during the four months ending March 31 last.

We have on our lines equal to 1,470 miles of single main track, which would show that we have had to remove but one broken rail from every $4^{3}/_{5}$ miles of single track, which with the very large traffic we have over the greater portion of our lines is, as we think, not an unduly large number of broken rails to have had on our lines.

The chief trouble we find with the rails we have been getting in recent years is that we are not getting the wear out of them we should. We have endeavored to correct this trouble by asking the steel company from whom we buy most of our rails to furnish us a rail higher in carbon, but they have been unwilling to do this, apparently fearing that the rails would be made more brittle should they use a greater percentage of carbon in them.

As to the rail we are getting for 1907 delivery, we have arranged through our rail inspector to have the rails held a little longer before they go through the rolls on their final passage, the idea being by this means to get better wear out of them and a somewhat tougher rail, due to the last rolling being at a lower temperature.

We have been experimenting in a small way with some open hearth rail we got several years ago from the Tennessee Coal & Iron Company and we are quite favorably impressed with the comparative results we have gotten from the use of this open hearth rail as compared with the Bessemer of the same weight, laid where it has had the same wear as the open hearth rail. As soon as we can get concerns here in the East to furnish us any quantity of open hearth rail we are going to use it more extensively.

The opinion of our people seems to be that the inferior quality of Bessemer rail which we have been getting recently has been due to two causes: One is that the ores which can be manufactured by the Bessemer process and have given a good wearing rail are growing scarcer and the ore is of a poorer quality and that with these ores a better rail can be produced by treatment with the open hearth process than by the Bessemer. We think, furthermore, that to some extent the poor quality of rail we are now getting is due to the fabrication of it and that the great endeavor of the rail makers of recent years has been to turn out a large tonnage and that in doing this the rail is rolled hotter and without as many passes through the rolls as in former years, and, as result, the metal in the finished rail is not as tough or strong as that in the rails formerly furnished by the steel rail makers.

Prior to about 1901 the different companies making rails in the United States gave certain guarantees as to the quality and wear of their rails. Since about that time no contracts can be obtained with any of the rail makers of this country giving any guarantees whatever as to the wearing qualities of the rail furnished. As a rule they will not go further than to replace such rails as in service are broken and show actual flaws in the individual rails. There can be no question but what since the provisions referred to in the old rail contracts have been eliminated, the quality of rail furnished has deteriorated.

Several years ago we increased our standard rail from 80 to 90 lbs. per yard. This with a view of better providing for our increased traffic and the increased weight of our motive power and equipment. At the time we decided to increase our standard weight of rail from 80 to 90 lbs. we investigated the question of whether we would go from 80 to 100 lb. rails, but as result of our investigation of the matter and a trial of some 100-lb. rails, we found that the lines using this heavier rail were not getting sufficient additional wear from it to warrant the increased cost of same. We also found that as a result of our trial of the 100-lb. rail laid right alongside 90-lb. rail, the 100-lb. gave no better wear under the same traffic condition than the 90-lb. In fact, the 100-lb. rail showed greater wear than the 90. This seemed to demonstrate that the heavier the rail, the poorer the material in it. I think this is the result of the

experience of other companies so far as we have been able to ascertain. —PRESIDENT.

There is no question that breakages of rails, rolled in the last few years, have been more numerous than those previously rolled. We have had a great many 80-lb. rails broken that have been rolled in the past five years. In 1904 we had removed 778 broken rails that had failed in track, manufactured by the X mill and the Z mill. Most of the X rails failed through what is known as piping and the Z rails through flange breaking. We have also had a very large amount of broken rails manufactured by the B Steel Company. These have broken in different manners; some being badly piped while others have just broken square off, through some defects.

In the fall of 1903 we started to buy 100-lb. rails. The records of the B Steel Company show quite badly, as to breaking of their 100-lb. rail that we got in the early rolling, but in the last rolling, that is to say in 1905, the record is not so bad. The rails they furnished us in 1904 seem to be the worst.

The rails we received from the Q Steel Company, previous to 1906, gave very good results, in fact, were the best rails we have purchased in recent years. But, we have had a great many broken rails from their 1906 rolling. It is my opinion that one of the greatest troubles with rails we receive to-day is that the demand is so great that every particle of steel is used that will make a rail, without showing any defects on the surface. This seems to be especially true with the Q Steel Company's rail of 1906 rolling. Previous to that time the demand for their rails was not so great. They have small converters that will only convert about 4½ tons of iron into steel at one blow. Their ingots being large and converters being small, it gives them a better chance to pour more slowly with an opportunity for the gases to escape during the pouring. Last year they began to press their output, and it is a marked coincidence that as soon as they started to shove their mill and advertised their increased output their rails became more defective.

I think one of the greatest troubles with rails to-day is that too much steel is tried to be forced into the rail; in other words, they do not crop their ingots sufficiently to insure that all silicon and other impurities, which are lighter and rise to the top of the ingot, are cut off before the ingots are sent to the blooming and rolling mills. The chemical composition of our rails seems to be rather satisfactory. We do not have any trouble from excessive wear of flange in the head, which shows that our rails are not too soft. Of course, our curvature is light on the main line, and we have not been troubled nearly as much as some roads with heavier curvature as regards flange wearing.

In the fall of 1903 we laid B rails on a 6 deg. curve, and last year had to replace them owing to their having been badly worn in the side of the head from flange wearing. That gives a life of about three years to that rail in main track. At no other point has it been necessary to replace rails, on account of the flange wear, although some of our curves are 3 deg., and one or two of them 4½.

I am sure that if the mills would agree to crop their ingots more we would have very much better results. I know there are a great many people that argue that 100 lbs. is too large a section out of which to make a perfect rail, as compared with the 80-lb., but our experience has been that 80-lb. rails of recent manufacture, that is to say within the last four or five years, have failed just as readily as 100-lb. rails. It is the practice to give 100-lb. rails almost as many passes as 80-lb. rails get.

We are now tabulating our list of broken rails, with the object of taking it up with the manufacturers to see whether we cannot make some arrangements by which they will give us a better quality of rail, and incidentally to have replaced the broken rails. The only manufacturers that we have a written guarantee from is the Q Steel Company, although the mills that we have taken the matter up with have always been willing to replace broken and defective rails.

—CHIEF ENGINEER.

I beg to attach hereto a statement of the 85-lb. rails broken from January 1, 1906, to April 1, 1907, inclusive. The breakage of rails which we have sustained does not seem to have been caused by severe weather conditions or defective output of any particular mill.

It is the opinion of our engineering department that the rails as manufactured at the present time are of inferior quality to those which were rolled several years ago, and that they are subjected to such heavy loads that the least flaw or defect of any kind in the rail will cause it to break—the result of the continual hammering that it receives under our heavy traffic.

The manufacturers in all cases replace the broken rails with new rail where any flaws are found in the section. We believe that our present rail is too light for the heavy wear to which it is subjected, especially where we do not have sufficient ballast to hold the track to perfect line and surface. If the ballast conditions were perfect, 85-lb. rail would probably answer all purposes, but this condition exists on very few roads. —GENERAL MANAGER.

Statement of 85-Lb. Broken Rail, Jan. 1, 1906, to Apr. 1, 1907.—All Divisions.

Track.	Weight of rail.	Age Yrs.	Age Mons.	Cause.
Main.	85 lb.		7	Flaw in center of rail.
"	85 "		7	Flaw in center of rail.
"	85 "		7	Unknown.
"	85 "	Not known.		"
"	85 "	Not known.		"
"	85 "	1	5	Cracked in flange.
"	85 "	3	10	Flaw in rail.
"	85 "	4	..	Unknown.
"	85 "	2	4	"
"	85 "	3	2	"
"	85 "	1	6	"
"	85 "	3	6	"
"	85 "	2	..	"
"	85 "	..	2	Split in center of ball.
"	85 "	1	5	Rail cracked admitting frost.
"	85 "	2	5	Soft ties.
"	85 "	1	6	Cold weather.
"	85 "	3	5	Flaw in rail.
"	85 "	2	2	" " "
"	85 "	1	4	" " "
"	85 "	3	3	Unknown.
"	85 "	2	3	Unknown.
"	85 "	..	2	Flaw in rail.
"	85 "	Not known.		" in ball.
"	85 "	..	2	" in rail.
"	85 "	..	2	" in ball and web.
"	85 "	..	2	" in base of rail.
"	85 "	2	6	" in flange.
"	85 "	Not known.		Unknown.
"	85 "	2	10	Poor quality of rail.
"	85 "	3	1	Flaw in rail.
"	85 "	2	..	Unknown.
"	85 "	2	1	"
"	85 "	2	8	Flaw in rail.
"	85 "	3	7	Worn.

Our experience has been that of other lines, that during the past year rails recently put in track have broken in unusual numbers and we are still investigating with a view to ascertaining the cause and applying a remedy. The fact that the breakage occurs most frequently in the rail recently rolled which on our line is of a heavier section than we heretofore laid, indicates that it is not caused by heavy traffic or large engines. On the other hand, when these rails were rolled they were inspected carefully and the analysis indicated the metal to be of first quality.

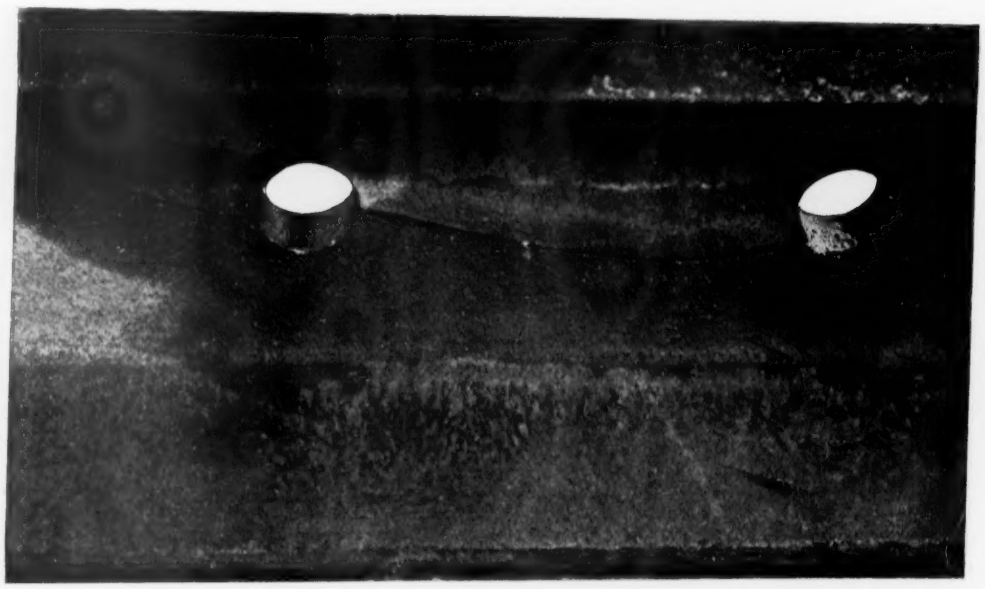


Fig. 13—Defective 100-lb. Rail.

The conclusion to which all of this points is that they were not properly worked at the mills, but put on the market with too few rollings.

I do not state this as a fact, but merely suggest that our experience and investigations up to this time tend to show that such is the case. —VICE-PRESIDENT.

The Swiss railroad employees who asked 120 francs apiece because rents and prices went up last year have been given by the Congress 100 francs for each married employee and 50 francs for each unmarried one; but this gratuity is limited to employees whose pay is less than 4,000 francs ($776) per year. The management says that expenditures will largely increase this year, more certainly than earnings.

Track Deformations and Their Prevention.*†

BY G. CUENOT,
Government Engineer of Bridges and Highways, and connected with the Board of Control of the Paris, Lyons & Mediterranean Railway.

X.

STUDY OF WOOD USED FOR TIES (CONTINUED).

In all the ties studied, the decay followed the same course. There is first produced the heating or the spotting of the wood not creosoted, situated immediately under the superficial crust penetrated with creosote, and that over the upper part of the tie, which is not covered up and is placed in the interior of the track. The spotted wood is that which has heated before seasoning by the fermentation of the sap moisture; in the beginning, the color, generally clear yellow for beech wood, commences to be spotted with characteristic white points, then to be marbleized with yellowish spots; the fibrous contexture disappears, the wood becomes spongy, becomes yellow colored,‡ and the shavings which are cut have no body and crumble. (Fig. 27.)

The next process is that the heating gains in depth and reaches all wood not creosoted, which affects the shape of a spindle on the longitudinal section of the cross tie, and is terminated in a fish tail towards the fastenings; the wood which is spotted and has first become yellow under the creosote crust of the surface, still intact, assumes a brown color, of touch-wood, and seems to be calcined. The tie preserves a very good appearance on the exterior, and the wood under the fastenings remains quite sound. (Fig. 28.)

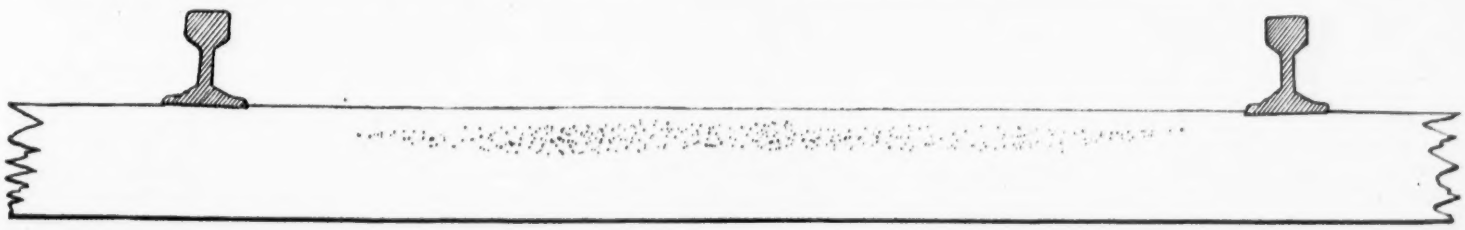


Fig. 27.

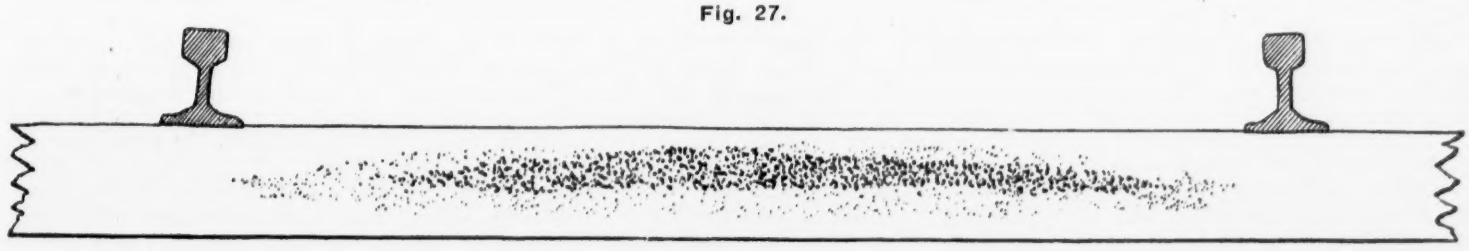


Fig. 28.

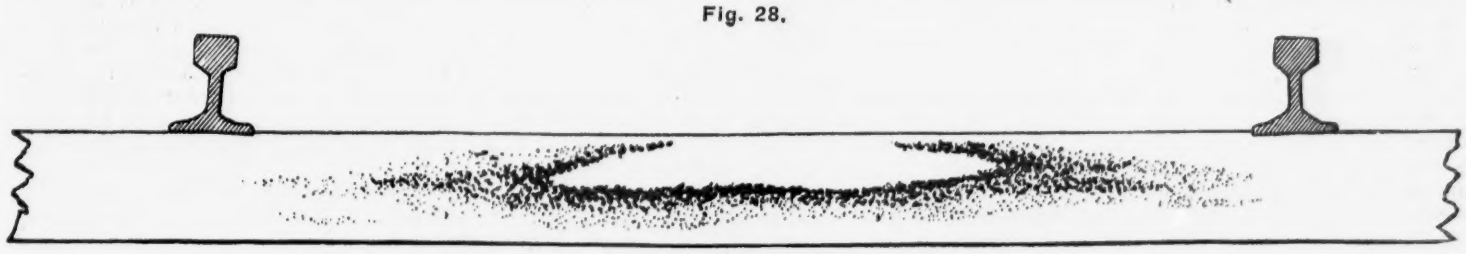


Fig. 29.

The creosoted superficial crust of the top next yields and is broken towards the middle of the inter-rail space; it forms a trough in the decayed wood, where water accumulates, and promotes decomposition. The decay reaches the fastenings more or less rapidly, which often hold sufficiently well, above all those of the exterior, but the tie is out of service. (Fig. 29.)

Some hundreds of decayed ties taken out of the track have been examined, and samples were taken from more than 10,000 ties in service, commencing to decompose; the same process of decomposition has always been observed in ties injected with 35 lbs. Beech wood very sound, but moist with sap, not injected, imprisoned in the superficial bed of creosoted wood, which prevents that sap from evaporating, becomes heated and decays rapidly by commencing at the part contiguous to the face free from ballast, exposed to the sun, which first becomes spotted.

A very conclusive experiment was tried on this subject, which is easy to repeat; there was available in the spring a half tie of very sound beech of recent felling, containing 35 to 40 per cent. of sap water. Two pieces, each 27½ in. long, were taken from it; after having tarred the first, it was buried in the ballast, leaving the upper face uncovered, exposed to the air, and the other piece, not tarred, was preserved as a witness, exposed to the air but not buried. At the end of six months the first piece was unburied, and it was observed while cutting it that it was heated and entirely spotted in the interior, but particularly under the uncovered face exposed to the sun, where the decomposition was remarkably much more advanced. The proof piece remained perfectly sound, and was dry; the other, on the contrary, had kept all of its moisture. That is what takes place in ties whose injection is only superficial.

INFLUENCE OF ADZING FOR THE PLATES AND BORING THE CROSS TIES BEFORE INJECTION, ON THE PENETRATION OF THE CREOSOTE.

In order to make the creosote penetrate better into that part of the tie which receives the screw spikes, the cutting and the boring are performed before injection, and this practice has been followed in France, in a general way, since 1894.

By comparing, by means of longitudinal sections and samples, previously taken from different points of their length, the ties injected after this procedure with those injected without holes, it is observed that the first are impregnated with creosote under the mortise and in the region of the holes; but the second are injected only at a distance from the extremities, which varies with the degree of humidity of the ties at the moment of injection, which often does not reach the mortise. And as the creosoted wood is not reached by decay, and as a single fiber of injected wood remains unimpaired in a center of decomposition, we are assured that boring the ties before injection increases their durability, and that it is a good practice.

Independently of the experiments related above, Mr. Ferry has made others on thousands of ties, developing the same facts. We will cite only one to show the influence of creosoting to refusal.

Of 1,152 beech ties, injected after this manner, and placed in 1877 on the line from Mouchard to Bourg, between kilometers 492,024 and 493,000, all were as sound in 1896, that is to say, 19 years after placing them, as on the first day, while 1,204 ties placed in 1889 on the same line, which were only injected with 37½ lbs. per tie, were entirely decayed, in the proportion of 35 per cent., at the end of six years.

The conclusion to be drawn from these experiments is that ties are generally creosoted very superficially, for the reason that it is not possible to obtain a complete drying for the extraction of all the water which they contain. Even by stove drying, the operation cannot be pushed sufficiently far to remove all the sap; we must therefore be contented with allowing the ties to dry naturally, which always shuts up a certain quantity of water, particularly in their center.

Injection practiced after an imperfect drying has also the effect of concentrating the water in that part, which becomes consequently a center of decomposition for the tie. Each tie then commences to decay in its center, which is the part exposed to the alternatives

†Authorized translation by W. C. Cushing, M.A., B.S., Chief Engineer of Maintenance of Way, Pennsylvania Lines West, Southwest System.

‡When the natural beech wood (not creosoted) becomes spotted it loses its clear yellow color and passes to straw yellow or citron yellow, and its fibrous texture disappears. It becomes spongy and in planing the shavings have no body and crumble away. It breaks with the least effort, "like a radish," that is to say, the fracture does not present drawn out fibers as are produced with sound wood; to use a local expression, it is "cooked." In this state, which is always the prelude of the red decay, the screw spikes no longer hold well in the tie, but turn without effort.

The yellow wood in question contains no trace of creosote, as the analysis of the shavings shows. However diluted the creosote may be, the traces are easily observed, even in wood very lightly tinted, or by compressing the wood in a press between two leaves of white blotting paper, or better, by treating it with benzine.

Both yellow wood and "cooked" wood are stages of decay.

of heat and dryness, while the extremities, better creosoted and under protection of the ballast, resist for a longer time.

TREATMENT OF PINE AND OAK.

The same process which has been found for beech is applicable for pine; the latter ought even to absorb a greater quantity of creosote. The same thing does not hold true with oak; the heart of the oak only takes traces of creosote, only the sap being penetrated by the injection. But this hard fiber is sometimes a disadvantage instead of an advantage; for if the heart of the oak is not dry (and it is hard to tell whether it is or not), the envelope of creosote prevents the slow evaporation of the sap, which finishes by being decomposed, and attacks in its depth the wood of most sound appearance. That is the cause of decay of the greatest number of ties, every piece of wood having more than 20 per cent. moisture, and covered over with a superficial bed, rapidly deteriorates, the beech at the end of three months, the oak at the end of a longer period.

The heart of the oak, which only absorbs a very small quantity of creosote because of its persistent state of moisture, is, however, susceptible of decay from a cause other than that of its superficial envelope preventing the slow and gradual evaporation of the sap. The wood is, in fact, generally very much cracked; under the action of atmospheric variations, these fissures open gradually wider and form a kind of trough, where the water enters vertically. At the end of a certain time this succession of moisture and of dryness favors the development of fungi, and produces work of decomposition in the wood, which always perishes in its central part, generally not covered over. It is worth while remembering that the simple bed of ballast placed on the breech of the tie, the plate placed under the rail, protects the wood in an efficient manner against this kind of decomposition. This evidently arises from the fact that, in the case of ties drying rapidly, like those of beech, the creosoting is more complete; but in the case of oak, which is only made superficially antiseptic, the fissures do not form as in the uncovered central part, and the decomposition of the wood is not produced.

AMOUNT OF CREOSOTE TO USE.

The preparation of wood before injection, and the proper drying of it, are very important. The amount of the injection ought equally to enter into the computation, for if it is insufficient, it prolongs but little the durability of the piece of wood. Results from actual experiment explain why, in spite of the expense which it induces, the amount of creosote used has tended constantly to be increased.*

In order to obtain satisfactory results, it was necessary to reach refusal; a point which is not absolute, and depends even upon the dimension of the piece submitted to injection. Thus, the beech ties, 8.86 ft. long and of ordinary dimensions, scarcely take 55 lbs., even to saturation; the pieces of more restricted dimensions, like the blocks of composite ties, absorb a greater quantity of creosote —20 per cent. more—because the water of sap is more completely eliminated. These pieces can then become indestructible and invariable in volume, as has been stated, whatever may be the agents to which they are submitted. The sap water having been replaced or surrounded by an antiseptic substance, the body is as though mummified, without undergoing any alteration in the future. This is what explains that, in spite of the variations in temperature, the blocks are maintained for nearly four years in the metallic skeletons without undergoing any modifications.

Experiments permit us to state these general points precisely; two pieces of beech were taken, one from a tree felled in the month of December, 1902, whose dimensions were: Length, 27½ in.; width, 9.8 in.; depth, 5.9 in., and they were placed under observation. When they had attained the degree of seasoning of 20 per cent., presenting then at their extremities important longitudinal clefts, they were submitted to two successive injections of creosote in such a manner that they absorbed the greatest possible quantity of it. The four faces of each of the blocks on three different sections were previously referenced to the tenth of a millimeter; they were referenced anew after the creosoting. The absorption of the creosote, at the rate of 18.7 lbs. per piece of wood, produced a mean elongation of each face of 0.04 in. and the fissures were completely closed. The void existing in a piece as dry as possible is then very small, scarcely 0.04 in. on each of its faces; it is the maximum play which can take place in the wood when it passes from the dry to the humid state, or inversely. But with an injection to refusal there is no play to fear, since the pores of the wood are filled up and can absorb no more, and since, on the other hand, the block protected by the metallic skeleton will not give up any part of the liquid absorbed.

I treated, like the beech, four blocks of heart oak; these pieces of wood did not absorb any appreciable weight of creosote, scarcely 0.44 lbs. each; that is to say, a quantity scarcely sufficient to coat them superficially.

Finally the wood, dried to an amount inferior to 20 per cent. by means of stove drying, for example, and replaced in air, regained moisture in a short time so as to reach the amount of 20 per cent. That which we will designate as dry wood will, then, be wood containing 20 per cent. of its weight of water.

INFLUENCE OF CREOSOTING ON THE RESISTANCE TO COMPRESSION.

But if creosoting has given favorable results from the point of view of the preservation of the wood, it acts, on the contrary, in an injurious way, to diminish the resistance of the piece submitted to compression. Mr. Ferry has made a series of very interesting experiments on the resistance to compression of pieces of wood submitted or not to an injection of creosote, and placed either in the direction of the fibers or perpendicular to that direction. An apparatus constructed by Mr. Collet was employed to produce this compression, and which permitted a pressure of 8.8 net tons to be reached; the wood was experimented with under the form of cubes of 2¾ in. each way. The results of the experiments are summarized in the table below:

	Load, lbs. per sq. in.	Deformation when load is applied perpendicular to the fibers: Following the Medullary rays.	Deformation when load is applied perpendicular to the fibers: Perpendicular to those rays.	Deformation of wood on end.
Dry oak	1,741	0.00290 m.	0.00380 m.	0.00117 m.
Dry beech	1,741	0.00160 m.	0.00350 m.	.....
Creosoted beech	1,741	0.00287 m.	0.00334 m.*	0.00105 m.
Spruce	508	0.00314 m.	.....	.....
Spruce	1,741	.....	0.000875 m.	.....

*Deformation obtained with 1,306 lbs. per sq. in.

These figures have not an absolute value, but a relative value, for it would be necessary, to obtain the former, to take account of the deformation of the apparatus itself, which has an influence on the results. What we should keep in mind, nevertheless, is that the deformation varies within sufficiently large limits, according to whether the force is exerted perpendicular to the fibers of the wood, to the medullary rays, or else in a perpendicular direction to those rays; finally, according as it is produced on the wood on end. Spruce resisted the best, at least in the perpendicular direction. The deformation in this direction would be about once and a half greater than it is in the perpendicular direction, that is to say, following the medullary rays. The deformation is accentuated when the wood is injected by about double; the liquid injected exudes at the same time that the increase of pressure is produced. In every case the deformation of the piece of wood takes a particular form: the spring layers, which are the most tender, crush, and the autumn layers, which are the hardest, slide over the first, giving the aspect of a series of checks.

These phenomena are manifested when the wood is in a free state; it does not seem that it should be thus when the wood, submitted to compression following the medullary rays, is prevented from being deformed, whether it be shut up in a skeleton which sustains it, or whether it be maintained in the transverse direction by a counter pressure. In this case it acquires a superior resistance and does not allow itself to be easily deformed because it is sustained.

That is what I have observed on composite ties by comparison with ordinary ties. It is recalled that the blocks of the composite tie are pressed between the walls of the skeleton by means of cross bars, and that the skeleton is thus shut up on these pieces of wood in order to compress them. It is thus possible to appreciate the influence of the compression of the wood in default of direct experiments.

(To be continued.)

*Amount of creosoting reported:

Oak	11 to 15.4 lbs. per cross tie.	(Refusal.)
Beech	28.6 lbs.	The Northern Co.
	33 to 35 lbs.	The Western Co.
	35 lbs.	The P. L. M. Co.
	52.8 lbs. (Refusal.)	The Eastern Co.
Pine	26.4 "	The Midland Co.
	30.8 "	The Orleans Co.
	26.4 "	The P. L. M. Co.

Comparative Summary of Freight Cars in Service on the Railroads of the United States.

There has recently been much haphazard guess work as to the number of freight cars in service and the increase during the year 1906. In order to get accurate figures on which to base an estimate for all the railroads in the United States, we have prepared the following table from data contained in the annual reports of all the railroads in the United States operating over 500 miles of roads with two or three minor exceptions. The 64 roads considered are divided into five groups comprising the New England roads, the roads in trunk line territory, the roads included in the southern freight classification, the roads included in the central freight classification and the roads included in the western freight classification. The first column gives the number of revenue freight cars in service in 1905, and the second column gives the number of cars in service at the corresponding date in 1906. No attempt has been made to distinguish between the roads reporting operations for the fiscal year ending June 30 and roads reporting operations for the calendar year ending December 31, as it is not believed that the overlap between the two periods affects the figures for comparative purposes. The third and fourth columns give the increase or decrease

COMPARATIVE SUMMARY OF FREIGHT CARS IN SERVICE ON THE RAILROADS OF THE UNITED STATES.

Road.	Freight equipment owned. 1905.	1906.	Increase.	Decrease.	Pr cent. of chnge.	Frt. cars per mile of road. 1905.	1906.	Average length of haul 1905.	1906.	Freight cars Per 1,000 frt. car miles 1905.	1906.	Per 1,000 rev. ton miles. 1905.	1906.	Rate per ton mile, dollars. 1905.	1906.	Frt. cars per $1,000 frt earnings 1905.	1906.
New England Roads.																	
Boston & Maine	17,401	18,321	920	..	5.3	7.6	8.0	90.24	89.16	.091	.089	.0094	.0091	.01152	.01162	0.82	0.79
Central Vermont	2,747	2,660†	.....	87	3.2	5.1	5.0	85.10	84.85	.089	.082	.0103	.0095	.00880	.00920	1.16	1.03
Maine Central	5,162	5,773	611	..	11.8	6.3	7.1	83.85	87.68	.133	.138	.0109	.0113	.01074	.01033	1.21	1.25
N. Y., N. H. & Hartford.	17,188	19,595*	2,407	..	14.0	8.2	9.5	95.13	93.22	.088	.096	.0099	.0103	.01408	.01407	0.70	0.74
Total	42,498	46,349	3,851	..	9.1	6.8	7.4	88.58	88.73	.100	.101	.0101	.0101	.01128	.01131	1.00	0.95
Trunk Line Roads.																	
Baltimore & Ohio	75,340	81,821*	6,481	..	8.6	19.9	20.3	188.93	193.72	.119	.115	.0084	.0076	.00566	.00560	1.49	1.36
Buffalo, Roch. & Pitts.	12,748	12,697*	.....	51	0.4	23.4	22.2	144.20	148.20	.162	.175	.0096	.0102	.00510	.00508	1.87	2.02
Cent. R. R. of N. Jersey	19,212	19,005*	.....	207	1.0	32.0	31.2	81.10	75.61	.152	.150	.0104	.0099	.00828	.00839	1.25	1.18
Chesapeake & Ohio	24,486	27,676	3,190	..	13.0	16.5	15.4	282.00	282.00	.124	.104	.0074	.0060	.00427	.00420	1.72	1.43
Delaware & Hudson	12,770	13,783	1,013	..	7.9	15.1	16.3	116.94	117.90	.100	.108	.0061	.0064	.00625	.00633	0.96	1.01
Del., Lack. & West'n.	23,881	26,593*	2,712	..	11.3	25.0	27.8	169.80	165.00	.103	.115	.0081	.0089	.00788	.00782	1.03	1.14
Erie	51,843	53,364	1,521	..	3.0	24.1	24.8	163.60	163.51	.122	.117	.0100	.0090	.00623	.00598	1.61	1.50
Lehigh Valley	35,769	37,161*	1,392	..	3.9	25.6	26.0	172.61	169.85	.120	.118	.0087	.0086	.00633	.00626	1.38	1.37
New York Central	65,410	69,070	3,660	..	5.6	17.4	18.2	197.00	190.00	.085	.090	.0078	.0082	.00613	.00642	1.25	1.26
Pennsylvania	105,832	119,036	13,204	..	12.5	27.6	30.6	107.87	107.47	.096	.104	.0063	.0065	.00593	.00595	1.05	1.08
Phila. & Reading	38,597	41,048*	2,451	..	6.4	38.0	41.1	93.50	91.89	.142	.145	.0103	.0099	.00870	.00790	1.28	1.27
Western Maryland	4,439	5,920*	1,481	..	33.5	9.1	10.9	58.93	65.96	.174	.174	.0123	.0119	.00762	.00728	1.61	1.64
Total	470,327	507,174	36,847	..	7.8	22.8	23.7	148.04	147.59	.125	.126	.0088	.0086	.00653	.00643	1.38	1.36
Southern Classification.																	
Atlantic Coast Line	15,272	17,850†	2,578	..	16.9	3.6	4.1	140.09	143.16	.092	.100	.0130	.0133	.01313	.01292	0.99	1.03
Central of Georgia	8,015	9,207	1,192	..	14.9	4.3	4.9	148.51	149.94	.123	.126	.0134	.0131	.01144	.01104	1.18	1.19
Louisville & Nashville.	34,306	36,386*	2,080	..	6.1	9.0	8.8	167.00	159.88	.113	.114	.0098	.0093	.00791	.00803	1.24	1.15
Mobile & Ohio	8,761	10,014	1,253	..	14.6	9.4	10.8	239.40	234.93	....	....	.0097	.0090	.00668	.00639	1.45	1.40
Nash., Chatt. & St. L.	8,049	8,508	459	..	5.7	6.6	6.9	162.00	161.00	.098	.129	.0101	.0094	.00900	.00900	1.12	1.05
Norfolk & Western	26,598	31,393	4,795	..	18.0	14.8	16.9	269.38	260.11	.093	.099	.0063	.0063	.00474	.00481	1.25	1.29
Seaboard Air Line	10,332	9,860	.....	472	4.6	4.0	3.8	152.13	158.55	.124	.098	.0127	.0103	.01180	.01121	1.08	0.91
Southern	41,055	47,816†	6,761	..	16.5	5.7	6.5	160.46	165.25	.115	.125	.0122	.0123	.00944	.00930	1.29	1.32
Total	152,388	171,034	18,646	..	12.2	7.2	7.1	179.87	179.12	.108	.113	.0109	.0104	.00927	.00909	1.20	1.17
Central Classification.																	
Chic., Ind. & Louis.	6,030	5,728	.....	302	5.0	10.2	9.7	157.00	152.60	.137	.134	.0119	.0110	.00790	.00796	1.51	1.38
Cin., Ham. & Dayton.	13,938	13,692*	.....	246	1.8	13.4	13.2	118.75	115.86	.212	.209	.0166	.0146	.00677	.00638	2.45	2.29
C., C., C. & St. Louis.	21,902	23,574*	1,672	..	7.6	11.0	11.9	147.90	152.60	.114	.116	.0096	.0093	.00598	.00592	1.53	1.50
Grand Rap. & Indiana.	3,227	3,225	.....	2	0.1	5.6	5.6	95.55	102.20	.107	.102	.0086	.0076	.00740	.00700	1.15	1.08
Lake Erie & Western.	4,765	4,603*	.....	162	3.4	5.4	5.3	145.41	140.07	.109	.101	.0086	.0078	.00681	.00675	1.25	1.15
Lake Shore & M. South.	27,938	35,167*	7,229	..	25.8	18.5	23.3	153.00	159.00	.079	.090	.0055	.0063	.00520	.00521	1.04	1.18
Michigan Central	16,109	18,600*	2,491	..	15.5	9.2	10.7	169.00	173.00	.069	.075	.0062	.0064	.00615	.00628	0.99	1.00
N. Y., Chic. & St. Louis.	8,023	7,827	.....	196	2.4	15.3	14.9	236.00	210.00	.061	.058	.0055	.0049	.00513	.00520	1.06	0.94
Penn. Company.	46,699	50,090	3,391	..	7.3	34.9	35.5	66.42	73.59	.145	.143	.0090	.0083	.00600	.00600	1.49	1.38
P., C., C. & St. L.	22,693	22,942	249	..	1.1	15.9	16.1	99.43	97.64	.080	.076	.0065	.0060	.00630	.00650	1.02	0.91
Pere Marquette	17,661	17,362	.....	299	1.7	7.6	7.4	157.08	170.86	.152	.138	.0135	.0107	.00689	.00597	1.95	1.81
Vandalia	6,446	6,950	504	..	7.8	9.8	10.2	88.04	103.95	....	....	.0102	.0090	.00740	.00700	1.38	1.28
Total	195,431	209,760	14,329	..	7.3	13.1	13.6	136.13	136.45	.116	.113	.0093	.0086	.00649	.00636	1.40	1.33
Western Classification.																	
Atch., Top. & S. Fe.	39,172	44,204	5,032	..	12.8	4.7	5.7	394.99	366.83	.083	.080	.0083	.0076	.01002	.00935	0.83	0.81
Chicago & Alton	9,699	10,061	362	..	3.7	10.6	10.4	165.76	172.43	.113	.108	.0096	.0086	.00689	.00639	1.59	1.34
Chic. & Eastern Illinois.	16,385	18,161	1,776	..	10.9	18.6	19.2	158.44	159.60	.176	.177	.0110	.0105	.00460	.00470	2.38	2.25
Chic. & North-Western.	52,231	55,816	3,585	..	6.9	7.1	7.5	137.89	144.07	....	....	.0122	.0108	.00920	.00890	1.33	1.22
Chic., Burl. & Quincy.	48,414	50,360*†	1,946	..	4.0	5.8	5.9	250.75	268.15	.102	.093	.0092	.0079	.00840	.00810	1.10	0.99
Chic. Great Western.	7,235	7,265	30	..	0.4	8.8	8.9	257.13	265.17	.103	.086	.0100	.0083	.00700	.00690	1.42	1.21
Chic., Mil. & St. Paul.	41,805	39,821	.....	1,984	4.8	6.6	5.7	175.14	177.99	.098	.087	.0102	.0085	.00881	.00862	1.16	0.99
Chic., R. I. & Pacific.	38,571	38,426*	.....	145	0.4	5.3	5.3	234.66	241.36	.120	.107	.0122	.0103	.00940	.00930	1.30	1.12
Chic., St. P., M. & O.	11,446	11,887*	441	..	3.8	6.8	7.0	155.94	146.07	....	....	.0131	.0127	.00930	.00931	1.41	1.36
Colorado & Southern.	6,173	7,058†	885	..	14.3	4.5	4.2	129.00	134.00	.141	.109	.0116	.0088	.01072	.01025	1.11	0.86
Denver & Rio Grande.	9,688	10,159†	471	..	4.9	6.2	6.3	124.48	126.28	.154	.150	.0150	.0129	.01340	.01290	1.12	0.99
Duluth, S. S. & A.	2,555	2,842	287	..	1.1	4.4	4.8	104.07	110.78	....	....	.0143	.0125	.00939	.00850	1.50	1.46
Great Northern	32,495	34,514	2,019	..	6.2	5.7	5.8	237.80	256.25	.109	.100	.0078	.0070	.00792	.00791	0.97	0.87
Illinois Central	54,764	56,227*	1,463	..	2.7	12.5	12.7	240.15	242.99	.120	.117	.0098	.0090	.00587	.00556	1.68	1.62
Iowa Central	3,197	3,154*	.....	43	1.3	5.7	5.7	172.48	164.23	.107	.117	.0079	.0094	.00591	.00598	1.34	1.57
Kan. City Southern.	5,997	6,979*	982	..	16.4	7.2	8.4	300.98	316.03	.104	.111	.0081	.0080	.00729	.00679	1.10	1.17
Minn. & St. Louis	3,420	3,199	.....	221	6.5	4.8	4.0	93.59	93.52	.202	.160	.0186	.0145	.01098	.01153	1.69	1.29
M., St. P. & S. Ste. M.	10,438	11,912	1,474	..	14.1	5.9	5.8	225.51	221.87	.138	.137	.0118	.0110	.00724	.00781	1.63	1.41
Missouri Pacific	39,491	39,370*	.....	121	0.3	6.4	6.3	228.10	237.33	.130	.119	.0109	.0094	.00825	.00776	1.33	1.21
Mo., Kan. & Texas	14,961	15,924	963	..	6.1	4.9	5.2	232.46	240.13	.101	.106	.0118	.0114	.01110	.01069	1.06	1.06
Northern Pacific	35,135	36,097	962	..	2.7	6.6	6.7	334.40	341.60	.092	.087	.0081	.0069	.00832	.00828	0.95	0.82
St. Louis & S. Francisco	24,800	24,963	163	..	0.7	4.9	4.9	156.31	166.52	.136	.124	.0124	.0108	.01005	.00952	1.14	1.23
St. Louis South-Western	10,281	10,131	.....	150	1.6	7.2	7.0	219.08	239.29	.182	.172	.0168	.0148	.01070	.00980	1.66	1.51
San. Ant. & Aran. Pass	1,723	1,702	.....	21	1.2	2.4	2.4	156.80	156.19	.104	.100	.0135	.0123	.01439	.01672	0.90	0.74
Southern Pacific	44,050	43,567*†	.....	483	1.1	4.8	4.7	268.20	262.31	.091	.086	.0080	.0070	.01052	.01025	0.75	0.68
Texas & Pacific	8,926	8,656*	.....	270	3.2	4.9	4.7	195.90	203.04	.105	.086	.0110	.0090	.01010	.01030	1.08	0.88
Wabash	18,822	18,692	.....	130	0.7	7.5	7.4	228.15	247.30	.093	.078	.0081	.0063	.00583	.00544	1.38	1.16
Wisconsin Central	8,640	8,548	.....	92	1.1	8.8	8.7	175.77	185.12	....	....	.0116	.0106	.00666	.00661	1.75	1.61
Total	600,514	619,695	19,181	..	3.2	6.8	6.8	205.28	210.26	.121	.112	.0112	.0090	.00887	.00872	1.31	1.19
Total, all roads.	1,461,158	1,554,012	92,854	..	6.35	11.0	11.3	171.11	173.18	.118	.114	.0103	.0091	.00819	.00806	1.31	1.23

*Does not include ballast cars.
†Standard gage cars only.

in number of cars in service and the fifth column shows the per cent. of change. Columns 6 to 11 are self-explanatory and are useful as indicating the character of the traffic on the different roads.

The 64 roads included in the table had a total of 1,554,012 cars available for service in 1906, an increase of 92,854 cars, or 6.35 per cent., over 1905. These 64 roads operate approximately 163,511 miles, or 75 per cent. of the total mileage in the United States, and own 90 per cent. of all the freight cars in the United States. The increase over 1905 is equivalent to an increase of 103,000 cars for all the railroads in the United States. Our record of the cars built in the United States in 1906 for domestic use shows a total of 229,189, which does not include a large number of cars built by the railroads in their own shops. The difference between these two figures (116,000 cars) should represent approximately the number of cars destroyed during the year. The best evidence that large numbers of cars are destroyed each year is shown by the total net decrease, which is 5,684. The Chicago, Milwaukee & St. Paul alone decreased its equipment by 1,984 cars during the year, due chiefly to the destruction of large numbers of old, light capacity cars, which were replaced in part by new cars of larger carrying capacity; in fact, most of the decreases shown may be attributed to this cause, and the only proper method of comparing the equipment of such roads would be a comparison of the total tonnage capacity of all cars. These figures, however, are not available in the majority of cases. The largest increase in per cent. was in the Southern group with the New England roads next. The largest increase in numbers was in the trunk line roads with the western roads next. The Pennsylvania Railroad increased its equipment by 13,204 cars, or 12½ per cent., while the Lake Shore showed the next largest individual increase, with 7,229 cars, or 25.8 per cent. The Western Maryland increased 33.5 per cent., but it owns a comparatively small number of cars per mile of road. The Philadelphia & Reading owns 41.1 cars per mile of road, while the Pennsylvania Company owns 35.5 cars per mile of road. The Pennsylvania Railroad, with 119,083 cars, is the only road owning over 100,000 freight cars, the Baltimore & Ohio, with 81,821, coming next in the list.

Of course, the most interesting use of this table lies in the opportunity it affords to compare equipment with needs, and to show which roads are likely to be enforced lenders and which borrowers in a period of car shortage. The column showing freight cars per thousand revenue ton miles casts the most light on this. It will be seen that the Buffalo, Rochester & Pittsburg and the Western Maryland have equipment nearer in line with their maximum needs than any other roads in trunk line territory (though, being originating lines, they have plenty of trouble in getting their cars home!). The Chesapeake & Ohio, Delaware & Hudson and Pennsylvania have the least equipment per thousand revenue ton miles of any roads in trunk line territory, although the Pennsylvania is notably well equipped per mile of line. In this case, the tremendous tonnage which passes over Pennsylvania lines in transit from foreign lines tends to keep the figure down; the company is primarily an intermediary and an agent, rather than a borrower. This is true to a much less degree in the case of the Chesapeake & Ohio, and is not true in the case of the Delaware & Hudson.

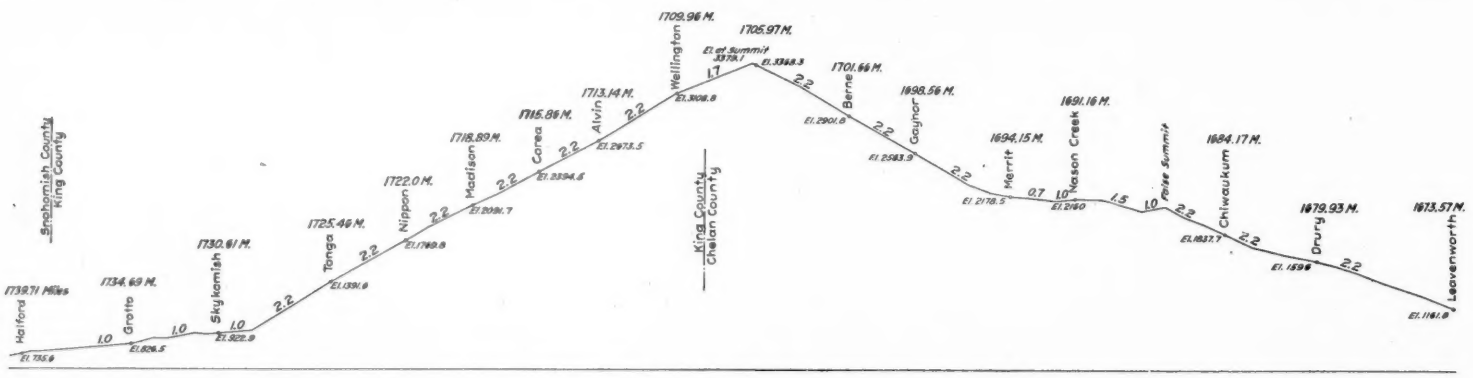
Per mile of road, the Reading and Pennsylvania lines stand pre-eminently at the head of the list, all classifications. Per thousand revenue ton miles, the smaller roads and systems lead, especially in the South and Southwest. Originating roads need more cars per unit of traffic comparison than intermediary roads do. For effective use of the table, it is necessary to compare roads operating under similar conditions and doing the same general kind of business. With this caution in mind, it can be made very valuable.

The Prussian authorities propose to impose a toll of 0.04 pfennig per ton per kilometer on all freight shipped on rivers, the navigation of which has been improved by government works. This would amount for an Erie canal boat carrying 200 tons to 1⅛ cents per mile, or about $4.10 from Buffalo to Troy. Prussia has about 3,350 miles of improved rivers, on some 900 miles of which tolls are already levied. The tolls are urged as a matter of justice to shippers by rail, who have to pay not only the cost of carriage, but a good deal more for interest on the investment, and at the same time help pay the taxes for the improvement and maintenance of rivers.

The Mallet Compound Locomotives on the Great Northern.

The Mallet compound locomotives that were built by the Baldwin Locomotive Works for the Great Northern Railway, and which were illustrated in detail in the *Railroad Gazette* for August 17 and October 12, 1906, have now been in service long enough to give some indication of their efficiency. They are used as pushers over the grades of the Cascade range, and tests show that they are capable of hauling an average train load of 1,265.6 tons from Leavenworth to the Cascade tunnel, a distance of 32.2 miles, where the maximum grade is 2.2 per cent., and where it averages 1.3 per cent. for the whole distance. It will be remembered that the Mallet engine weighs 355,000 lbs., of which 316,000 lbs. are upon the driving wheels, and that it has a tractive power of 71,600 lbs. The figures given above are averages of nine trains in which the tonnage hauled ranged from 1,015 to 1,391 tons, and the coal burned from 19,000 to 27,000 lbs., with an average of 23,100 lbs., or 0.896 lb. per ton-mile, or 2.8 train-miles per ton of coal, from which it appears that the average evaporation was 4.44 lbs. of water per pound of coal. This low rate of evaporation is probably due to the quality of the coal used, which was from the Gilman mines.

In comparing this with the consolidation engine No. 1,152 it appears that the latter could haul but 454 tons over the same grades, burning 24,000 lbs. of coal and evaporating water at a rate of 4.03 lbs. per pound of fuel. Further, it burned 1.64 lbs. of coal per ton-mile, or 2.68 train-miles per ton of coal. Finally the water used per ton-mile of train was 3.96 lbs. on the Mallet and 6.65 on the consolidation. By comparing these two sets of figures it will be seen that the Mallet showed a saving in fuel of 43.8 per cent. per ton-mile, and in water of 40.8 per cent.



Condensed Profile of Cascade Division, Great Northern, from Leavenworth to Seattle.

The following is a detailed statement of the particulars of these runs between Leavenworth and the Cascade tunnel:

Distance	32.2 miles
Running time	4 hrs.
Time lost by stops	3 hrs. 4 mins.
Total time	7 hrs. 4 mins.
Average speed (miles per hour.)	8.05 miles
Grade coal used	Gilman, Crow's Nest, Coast and Sand Coulee
Pounds of coal per trip.	23,100 lbs.
Coal per sq. ft. of grate per hour	74.03 "
Coal per mile	717 "
Coal per 100 ton-miles	89.6"
Average tonnage handled	810 tons
Average No. cars per train (all loaded)	21
Temperature of atmosphere	40 degs. Fahr.
Temperature of feed water	40 degs. Fahr.
Maximum boiler pressure	205 lbs.
Minimum boiler pressure	195 "
Average boiler pressure	200 "
Water evaporated per lb. of coal	4.44 "
Water evaporated from and at 212 degs.	5.08 "
Maximum grade	2.2 per cent.
Minimum grade	Level
Water rate or steam consumption per h.p. hour from indicator cards)	21.79 lbs.
Indicated tractive power	60,000 "

The following are some of the principal dimensions of the consolidation locomotives with which this comparison is made:

Cylinders, diameter	20 in.
Piston, stroke	32 "
Steam pressure	210 lbs.
Weight on drivers	180,000 "
" of engine	195,000 "
" of engine and tender	318,000 "
Tank capacity, coal	12 tons
Tank capacity, water	6,000 gals.
Heating surface, tubes	2,572.0 sq. ft.
" " firebox	195.4 "
" " total	2,767.4 "
Grate area	59.2 "
Tubes, diameter	2 in.
" length	14 ft. 8 "
Firebox, length	118 "
Firebox width	72¼ "
Tractive power at 80 per cent. of boiler pressure	39,090 lbs.

$$\frac{\text{Weight on drivers}}{\text{Tractive power}} = 4.6$$

$$\frac{\text{Total weight}}{\text{Tractive power}} = 5.0$$

$$\frac{\text{Tractive power x diameter drivers}}{\text{Heating surface}} = 164.24$$

$$\frac{\text{Heating surface}}{\text{Grate area}} = 46.74$$

$$\frac{\text{Firebox heating surface}}{\text{Total heating surface}} = 0.076$$

$$\frac{\text{Weight on drivers}}{\text{Heating surface}} = 65.04$$

$$\frac{\text{Total weight}}{\text{Heating surface}} = 70.46$$

Volume of 2 cylinders = 11.47 cu. ft.

$$\frac{\text{Heating surface}}{\text{Volume of 2 cylinders}} = 241.21$$

$$\frac{\text{Grate area}}{\text{Volume of 2 cylinders}} = 5.16$$

Equated tube to firebox heating surface (Vaughan's formula) ..... 722.56 sq. ft.
Total equated firebox heating surface ..... 917.96 "

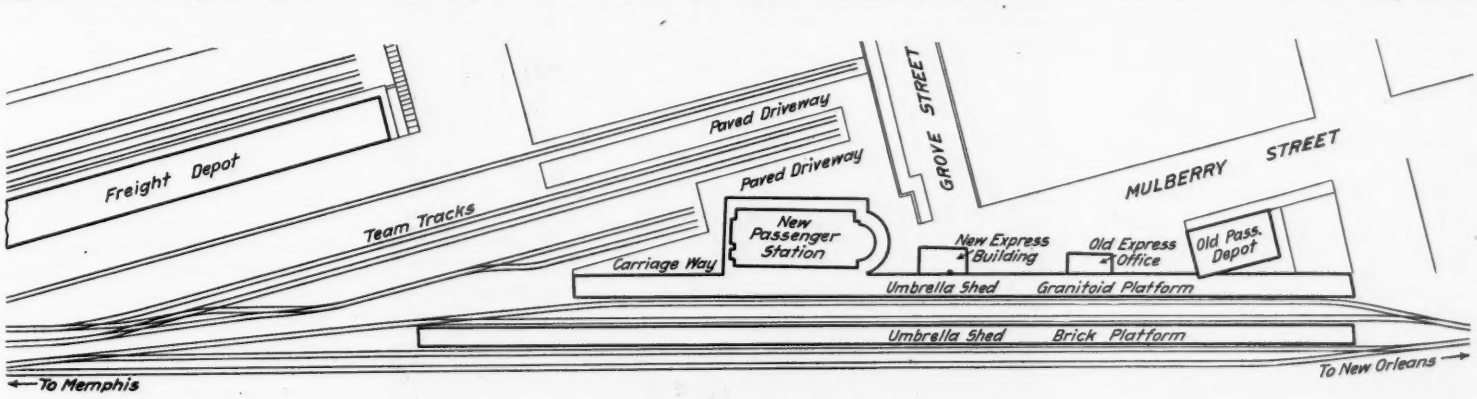
New Passenger Station for the Y. & M. V. at Vicksburg.

The Illinois Central Railroad has begun building a new passenger station at Vicksburg, Miss., for the Yazoo & Mississippi Valley. The railroad skirts the Mississippi river front the entire length of the city and the present passenger station is at the foot of China street. It is a two-story frame building, the second story containing the division operating offices. The site of the new station is one block north of the old station, at the foot of Grove street. Ground space in addition to what was already owned was obtained from the city through the vacation of Mulberry street, in exchange for which the railroad company will provide a paved 30-ft. driveway approach from Jackson street to the station through the property lying east of same, which it owns. An approach of this character from Jackson street is a necessity from the fact tnat, as Vicksburg stands on the river bluffs, all streets leading down from the business part of the city are on a steep incline, the grade of Grove street, for instance, being 13.3 per cent.

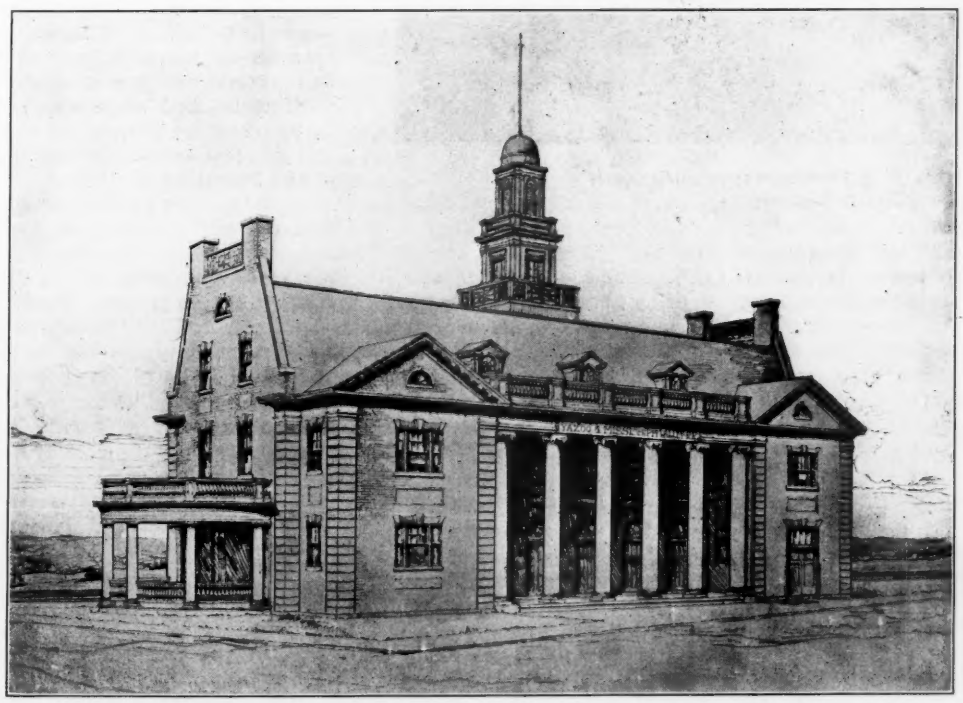
The presence at Vicksburg of a National Military Park brings to the city a great many visitors, and this was one reason for wanting to have a handsome station there. A favorite type of residential architecture in the city, and throughout the South in fact, is the colonial, and this type was therefore chosen for the station. The accompanying engraving is made from the architect's drawing of the accepted design.

The building has three stories and a basement, with a central tower 72½ ft. high. It is 100 ft. long, exclusive of the porch at the south end, and 40 ft. wide. The foundation is concrete on piling, the soil being silt deposited by the river. The walls are red paving brick, except that every fourth course has black headers, these courses being laid alternately stretcher and header. The trimmings are buff Bedford stone and the columns of the loggia and porch are wood. The roof is slate, except the flat portion, which is composition, and the dome of the tower is covered with copper.

The east or main entrance is through a loggia 50 ft. long and 9 ft. 6 in. wide, with five doorways leading to the interior—two to each waiting room and one to the hall for the second story stairway. The main section of the general waiting room is 33 ft. x 25 ft., with an alcove 17 ft. 8 in. x 17 ft. 6 in. at the south end lying between the smoking room and the women's room. There is a large fireplace at the south end of this alcove, with a doorway each side opening on to a semi-circular porch of 13 ft. 5 in. radius. It is the intention to keep palms on this porch in the mild seasons, adding to the attractiveness of the station and in making it as comfortable and pleasant as possible for waiting passengers. The negroes' waiting room is practically the same size as the main portion



Track Plan; Vicksburg Station.



Architect's Sketch of Vicksburg Station.

of the general waiting room, with a fireplace in the north wall, and toilet facilities, as shown on the plan. The ceilings of the waiting rooms are 12 ft. high. Both rooms have plaster walls above a wooden base, the walls being divided into upper and lower panels by a wooden chair rail. The ceilings are plaster also. The floors are maple except in the toilet rooms, which are mosaic. The floors of the loggia and porch are cement. At the north end of the building is the baggage room, extending entirely across the end and 16 ft. 7 in. wide inside.

The second floor of the building will contain the offices of the division superintendent and his staff. The partitions between the offices are to be glass, with movable sash or transoms in upper part to permit all possible circulation of air during the hot months. The transoms will be clear glass and the remainder of the partition maze glass. The third or attic floor will have space finished for the claim agent and the traveling auditor. The remainder will not be finished until needed. The heating plant will be located in the basement.

As the general plan shows, there will be four station tracks, with umbrella sheds. The station platform will be granitoid and the intertrack platform brick. Paved driveways and grass plots will surround the

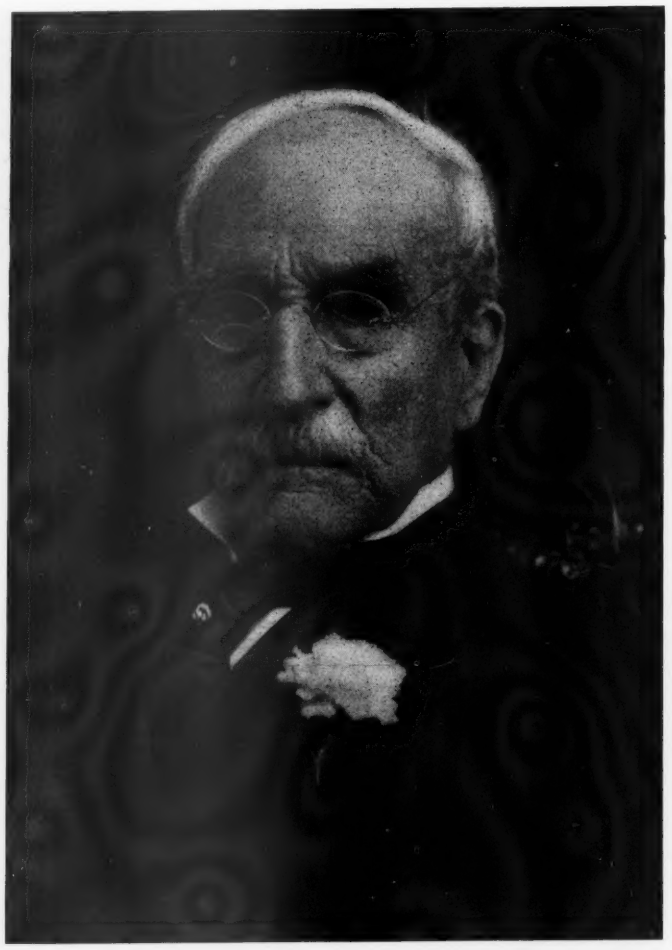
building, and Mulberry and Grove streets also are to be paved. D. H. Burnham & Co., Chicago, are the architects for the station, and the George B. Swift Co., Chicago, the contractor. The station and improvements will cost about $75,000. It is expected to have it ready the latter part of the summer. We are indebted to Mr. A. S. Baldwin, Chief Engineer of the Illinois Central, for data.

Charles Haynes Haswell.

BY NELSON P. LEWIS.

Through the death of Charles Haynes Haswell on May 12, at his home in New York City, the engineering profession has lost one of its most conspicuous members. Mr. Haswell was undoubtedly the oldest engineer in the world, and had he lived 10 days longer he would have entered upon his 99th year. Those with whom he was actively associated have long since passed away; he belonged to another day and generation, and as he rarely spoke of his personal achievements it is very difficult to secure details concerning his professional career.

He was born on May 22, 1809, in a house still standing on North Moore street in New York City, and was a son of Charles Haswell, who was a native of Dublin and was in the diplomatic service of England, and of Dorthea Haynes, whose family was prominent in the Barbadoes. After a liberal training in the best schools of New York City and Long Island, he entered the service of James P. Allaire, the owner of what was then the largest steam engine works in the United States. Here he acquired a practical and thorough knowledge of mechanical and marine engineering. His excellent work soon attracted the attention of the United States Navy Department, and he was commissioned to design the machinery of the United States steam frigate "Fulton," the construction of whose engines and boilers he superintended as Chief Engineer, his commission having been signed by President Jackson. He subsequently designed or supervised the construction of the warships "Missouri," "Mississippi," "Michigan" and "Allegheny" and several revenue cutters. In 1843 Mr. Haswell was appointed the first Engineer-in-Chief of the United States navy, which position he held for eight years. Into this important office he carried his high professional ideas, and his fidelity to duty as interpreted by those ideals—qualities which were not always appreciated by his superior officers—and in 1851 he resigned from the naval service and engaged in private practice in New York City.



Charles Haynes Haswell.
Courtesy of The Knickerbocker Pub. Co.

While Mr. Haswell's work has covered nearly all branches of civil and mechanical engineering, and while he was the author of kind for 64 years and has passed through more than 70 editions, he was best known in connection with marine and steam engineering. He has been called the creator of the modern steam yacht; the "Sweetheart," probably the first vessel of this type, was designed and built by him in Brooklyn some time before 1840.

When the Civil War came, Mr. Haswell showed a fervent patriotism, and was not only assigned by the "Committee of Citizens of New York" to a mission requiring much tact and discretion, but rendered important service in the navy, which was recognized by General Burnside in his reports to the Secretary of War.

Appreciation of his professional work has not been confined to his own country. More than half a century ago the Czar of Russia sent him a diamond ring with an expression of his thanks for services rendered to the Imperial Government in sending to it a number of plans and drawings.

British engineers and naval architects have given frequent expression to their high regard for and deep obligations to him, and on the occasion of the visit of the Institution of Civil Engineers to this country in 1904, he was the recipient of conspicuous attention from them and their president, Sir William White.

[At that time, an excursion was made to West Point, and the officers of the Institution of Civil Engineers reviewed the cadets. Mr. Haswell, in his ninety-sixth year, walked with them down the line unaided, except for a friendly hand upon his arm. His firm and erect attitude and his picturesque appearance, intensified by the battered old silk hat he wore, greatly impressed the writer.—EDITOR.]

As a citizen of New York he has always been active and public spirited. From 1855 to 1858 he was a member of the City Board of Councilmen, of which body he was the presiding officer in 1858. He also served for some years as one of the trustees of the Brooklyn bridge.

With advancing years Mr. Haswell's professional activities had naturally become limited, but for the last decade he served the city of New York as Consulting Engineer to the Board of Public Improvements and the Board of Estimate and Apportionment, and those who have enjoyed the privilege of association with him have not only revered and honored him as an engineer, but have been impressed with his rare personal qualities.

His early education, as already noted, was obtained in the classical schools of the early part of the last century, and there was a refinement in his manner and conversation which showed the influence of that training. While used without a suggestion of pedantry, his Latin quotations frequently gave force and charm to his conversation. His gentleness and uniform courtesy toward those many years his junior made him a delightful companion and a welcome visitor. His tall, erect figure made him conspicuous in any assembly, while his great modesty and unwillingness to speak of himself made it difficult to realize the important service which he had rendered to his profession and his country.

His anecdotes covering the New York of his youth, of his going out to the neighborhood of Canal street with an older relative for pistol practice, where there was no danger of injuring anyone, and of his shooting woodcock in 23d street made one realize how recent a thing is the physical greatness of this city. His "Reminiscences of an Octogenarian," published in 1897, while lacking continuity of narrative, gives some admirable and interesting sketches of New York between the years 1816 and 1860, and affords evidence of the refined tastes and admirable public spirit of the author.

Mr. Haswell was a member of the American Society of Civil Engineers, the British Institution of Civil Engineers, the Institution of Naval Engineers of Great Britain and of the Naval Engineers of the United States, the Municipal Engineers of the City of New York, the American Institution of Architects, the New York Academy of Science, the New York Microscopical Society and the Society of Authors. He was also a member of the Engineers' Club of New York and the Engineers' Club of Philadelphia, and was the oldest member of the Union Club of New York City.

Suspension of Service on European Railroads.

A note was published in the *Railroad Gazette* of March 8, 1907, regarding the suspension of service on the Hungarian state roads owing to a congestion of terminal and station facilities. It appears from the *Journal des Transports* that this suspension of service is not entirely unknown in other European countries. On the 29th of January there was promulgated from Brussels the following order affecting the state railroads of Belgium: "In consequence of the extraordinary amount of traffic that has been received the acceptance of carload lots of merchandise, intended for the frontier towns of Sterpenich, Athus, Renonchamps and Lamorteau will be sus-

pended for 48 hours." Thus, under a pretext of an embarrassment caused by the legitimate claims of its shippers, the administrations of the State Railroads of Belgium calmly suspended the acceptance of slow-speed merchandise for a period of 48 hours in carload lots that were intended for exportation. This is certainly an expeditious manner of simplifying railroad service.

In the case of the Hungarian roads, in the order already alluded to, of suspending the acceptance of freight for Budapest, reference was made to the accumulations of freight in the stations at Christmas time as a calamity. Again in Austria, on about the 25th of December, the Nord-Ferdinand, which is a state road, was also clogged with freight and suspended service for a time. The order for this reads that this condition of affairs has compelled the management to entirely suspend all slow-speed freight service for a few days, or until the present accumulations have been delivered.

Finally the same "calamity" has occurred on the new nationalized system in Italy in consequence of which a number of stations have been blocked with freight because of an insufficiency of rolling stock. For several weeks radical measures were taken against which the commercial interests of the peninsula naturally protested, nevertheless, the state, in order to avoid congestion, refused to accept certain classes of merchandise. A number of points were indicated for which no freight should be received, and in one case it lasted from the 22d of November to the 7th of December. Apparently, this method of relieving freight congestion has been more common in Italy than in any of the other countries mentioned, because it is quoted as having occurred, not only in November, but in December and in January, and due notices were issued at the time when the embargo was raised.

Kansas Railroad Laws.

The Board of Railroad Commissioners of Kansas, G. W. Kanavel, C. A. Riker and F. J. Ryan, have issued a pamphlet containing the railroad laws of that state, as amended to date, supplemented by the rules of practice for the conduct of proceedings before the commission. We note the principal changes made in the laws at the legislative session of the present year.

Chapter 268, published March 20, amends 11 sections of the former railroad laws. It prescribes the duties of the commissioners and clerks and fixes their salaries. It lays down elaborate and detailed provisions for the inspection and supervision of the railroads, express companies and sleeping car companies of the state. One section sets forth in particular a great number of items in connection with the property of the railroads of the state, concerning which the commission is required to gather information with a view to reporting what amount of money would be required to replace the physical properties. The commissioners may employ experts in this work, and the information gathered is to be printed "from time to time." Other sections of this law prescribe, with tiresome reiteration, the duties of the commission in its different fields.

Chapter 269 empowers the railroad commissioners to intervene in cases before the Interstate Commerce Commission, where the interests of Kansas shippers are involved.

Chapter 275 is a reciprocal demurrage law, requiring the railroads to furnish cars for shippers on demand; orders for 10 cars to be filled in three days; for 30 cars or more, 10 days; but these time limits do not excuse lack of diligence in furnishing cars. On failure to furnish cars ordered the railroad shall pay $5 per car per day to the person who applied for them, but the applicant must, if required, deposit with his requisition one-fourth of the freight charges on the prospective shipment, though not over $10 a car. If an applicant fails to load a car within 48 hours, he must pay the company $5 a day. There are provisions against bunching requisitions or bunching cars, and a shipper who does not use his cars must pay the $5 penalty and also pay damages to the company. But if an applicant elects to order cars without a deposit neither party shall be liable for the penalties. Freight must be transported at 50 miles a day, though this figure is not to be taken as a limit on the speed of live stock and perishable freight. Failure to transport shipments in good time involves a fine of $5 a day on carloads and five cents per 100 lbs. on less than carloads. With cars carrying 30 tons the consignee must be allowed 48 hours in which to unload, and for larger cars 72 hours. Where cars are bunched and delivered to consignee faster than he can unload, the carrier is to allow him such additional time as may be reasonably necessary. A shipper must be able, in ordering cars, to show that he had on hand the actual grain or other freight to put into them.

Chapter 270 requires the State Railroad Commission to investigate through freight rates and, if necessary, apply to the Interstate Commerce Commission for relief.

Chapter 272 regulates passenger fares. The ordinary single ticket rate is three cents a mile, but 2,000-mile tickets, good for the original purchaser, must be sold at $50 each, with a rebate of $9.50.

Chapter 278 fixes the maximum freight rates for certain grains. The rates in force January 1, 1907, are reduced 15 per cent., and the tariff rate must allow one stop-over for reconsignment or for milling, shelling, cleaning or storing, good for six months.

Chapter 271 requires the railroads to designate what cities or places shall be freight terminals, and requires the construction of proper freight houses and freight terminal facilities at such places. A railroad failing to comply shall forfeit $1,000 a day.

Chapter 282 requires railroads confiscating coal in transit to notify the consignee within three days, and within 30 days to pay him twice the invoiced price. If he has not received the invoice, twice the market value at point of origin. If the coal is billed to shipper's order, then payment is to be made to the person for whom the coal was intended. If a road delays payment for 30 days the consignee may recover, not only the double value, but an attorney's fee.

Chapter 276 requires live stock to be transported 15 miles an hour, exclusive of stops, unless unavoidable causes prevent. Failure makes a road liable for all damages, including depreciation of market price and shrinkage in the weight of animals.

Chapter 267 restates the general duties of the railroad commissioners.

Chapter 286 empowers the Mayor and council of a city of the first or second class to order an election to vote on granting aid to railroads; but not more than $30,000 in case of a first class city or $20,000 in a second class city.

Chapter 279 prohibits demurrage associations, or the employment of a common agent or bureau to collect demurrage rates.

Chapter 280 limits the working hours of trainmen, telegraph operators, etc., to 16 hours a day, with the usual conditions; but the crew of a train containing live stock or perishable freight in carload lots may run to the next division point. Any corporation or receiver knowingly violating this act shall be liable to $1,000 to $2,000 fine. The Commissioner of Labor is empowered to investigate complaints of violation, and to examine the railroad records. If he finds the complaint well founded he must lay it before the county attorney.

Chapter 281 fixes the liability of railroad companies to their employees for bodily injury. Every railroad is liable for all damages to any employee in consequence of any negligence of its agents or any mismanagement of its employees. Notice of the injury must be given in writing within eight months, but the notice need not state whether or not suit is intended to be brought.

Chapter 273 prohibits free transportation, with the usual exceptions. Among the persons excepted are a representative from each of the labor organizations of employees of the company, and employees who are on the retired list and who have been continuously in the service of the company for 15 years.

Chapter 277 requires railroads to furnish double-deck cars for the shipment of sheep, and if single-deck cars are used only one-half the regular rate for a carload lot may be charged.

Chapter 274 requires freight trains to carry passengers in the caboose on the same terms as on passenger trains, but persons under 15 years of age need not be carried unless accompanied by a competent person. Freights need not stop except at their regular stops, and the road may limit its liability, except as to wilful negligence. The caboose need not be stopped at the depot and the law does not apply to freight trains on main lines carrying live stock. Violation of this law by any officer or employee makes him liable to $100 fine or *30 days in jail*, or both.

Chapter 283 forbids railroads to build or repair cars or engines at division points where shops are located without providing sheds to shelter the workmen; penalty $25 to $100. This law goes into effect September 1.

Chapter 284 requires the chief officer of any state institution to sue a railroad which loses in transit any coal destined to such institution. Any state officer who neglects to notify the Attorney-General of the non-arrival of coal shall be deemed guilty of a misdemeanor and be fined not more than $500; and he shall be disqualified to longer hold his office.

Foreign Railroad Notes.

The Germans opened for traffic last January in their province of Togo on the Gulf of Guinea a new meter-gage railroad from the coast at Lorne north 76 miles through the palm-oil nut district into the highlands at Palime. They had previously a railroad from Lorne east directly along the coast to Anecho, about 25 miles.

Two new car works have been established in Douai, France, for the manufacture of cars of large capacity—40 to 50 kilometric tons. One of these will have capacity for 1,500 cars yearly.

The Japanese have already built a railroad on the southern part of the island of Saghalin, which part was assigned to them by the treaty of Portsmouth. There are coal mines on the island. Under their protectorate of southern Manchuria extensive shops

have been built at Mukden, intended, it is said, for building new cars and locomotives, as well for repairs.

The Henschel & Son locomotive works in Cassel turned out its 8,000th locomotive March 23. The 7,000th was finished Feb. 10, 1905. This firm has a contract for 110 locomotives for the Italian railroads.

Pennsylvania Railroad Improvements at Havre de Grace, Md.

The Pennsylvania Railroad has nearly completed the extensive improvements on the main line of the Philadelphia, Baltimore & Washington at Havre de Grace, Md., at the mouth of the Susquehanna river, and extending about 5½ miles, as far north as Principio and as far south as Oakington, which were begun in 1904. These include a new steel bridge, about a mile long, over the Susquehanna river, and changes in line on both sides of the river to eliminate grade crossings and straighten out curves. These improvements are part of the plans made to eventually reduce the running time between New York and Washington to four hours.

The new bridge is located about 150 ft. north of the old structure. The foundations contain 44,369 cu. yds. of masonry and 20,230,384 lbs. of iron and steel were used in the superstructure, which consists of 17 fixed deck spans and a through draw span 280 ft. long. The first fixed span on each end is 196 ft. 6 in. long; the remaining spans on the Havre de Grace end are each 200 ft. long, and on the Perryville end they are each 260 ft. long. The fixed spans have a clearance of 24 ft. 3 in. at mean tide, and the draw span has a clearance of 53 ft. The draw has a clear opening of 100 ft. on either side of the swing pier. The 20 piers are built of Alleghany Mountain sandstone with concrete backing and Port Deposit granite coping. They are at right angles to the bridge, with the exception of the two rest piers for the draw, which are swung 14 deg. to the west to bring them in line with the current of the river.

Pier No. 1, the east abutment, was built by open cofferdam construction on rock at an elevation of 4.4 ft. Excavation for piers 2, 3 and 4 was carried on by the open cofferdam construction, and in the case of pier 3 a depth of —32 ft. was reached. From the bottom of the excavations piles were driven to solid rock. In building pier 2, 294 piles were driven to a depth of —77 ft. Piers 3 and 4 each rest upon 390 piles driven to an average depth of —110 and —88 ft. respectively. The piles were all driven with a No. 2 steam hammer, and were followed below the top of the cofferdam by means of extension leads to the pile driver. They were sawed off and capped with concrete for a depth of 2 ft. below and 6 ft. above the heads. It was impracticable to put a timber grillage on top of the piles, as bracing of the cofferdam made it impossible to get timber of any length to the bottom of the excavations.

Piers 5 to 16, inclusive, were built on pneumatic caissons sunk to the following depths:

Pier.	Elevation of cutting edge.	Extreme depth, foundation.
No. 5.	— 74.6 ft.	— 76.8 ft.
" 6.	— 63.3 "	— 65.5 "
" 7.	— 87.5 "	— 87.6 "
" 8.	— 77.0 "	— 81.2 "
" 9.	— 42.5 "	— 46.0 "
East Rest Pier " 10.	— 42.7 "	— 48.9 "
Center Pier " 11.	— 38.3 "	— 45.5 "
West Rest Pier. " 12.	— 36.5 "	— 38.3 "
" 13.	— 35.8 "	— 37.9 "
" 14.	— 26.1 "	— 32.3 "
" 15.	— 21.0 "	— 23.6 "
" 16.	— 21.5 "	— 22.3 "

The caissons rest on rock, with the exception of pier 7, which rests on gravel, and pier 8, which rests on gravel and boulders.

It was the intention to build piers 14, 15 and 16 by the open cofferdam method, but the idea was abandoned for 14 and 15 because there was so little sand and mud where the piers were located, while in the case of pier 16 it was not given up until a month was spent trying to put in a cofferdam and prevent its leaking.

Piers 17, 18, 19 and the west abutment were built on rock in open cofferdams at the following elevations:

	Pier.	Elevation.	Pier.	Elevation.
West Abutment	No. 17.	— 17.2 ft.	No. 19.	— 1.5 ft.
	No. 18.	— 12.3 ft.	No. 20.	— 3.0 ft.

Work was started on the piers in the summer of 1904, but not much river work was done until the ice went out in 1905. The last masonry was laid on the fender pier December 16, 1905.

The fender at the draw is built of piles with a granite pier at the north end and a timber crib filled with stone at the south end. The granite pier rests on a caisson sunk to a depth of —44.8 ft., while the crib rests on the river bottom dredged to a depth of —30.5 ft.

Erection of the steel work was begun August 10, 1905, and finished May 22, 1906. The draw span was erected on falsework over the fender and swung into position May 19, 1906.

The curvature at each end of the bridge has been greatly reduced by changes in alinement. Two bad curves are eliminated south of Havre de Grace, there being a 2 deg. 5 min. curve to the left 2,626 ft. long, followed by a tangent 400 ft. long and then a 1 deg. curve to the right 4,537 ft. long. To offset this curvature, on the new line the following curves have been used: A 0 deg. 45 min. curve to the left 4,338 ft. long, then a tangent 3,847 ft. long, followed by a 0 deg. 40 min. curve to the right, 3,655 ft., which then returns to the old line. There is one other curve on the line, near Principio, a 0 deg. 30 min. curve to the right, 1,600 ft. long. On the old line near this point there is a 1 deg. curve to the right 1,600 ft. long. The difference in degrees of curvature between the old and the new lines is made up at the Principio end by going back on the 1 deg. 20 min. curve to the left, 600 ft., thus throwing the new tangent 8 deg. further north than the old tangent.

Old and New Bridges over the Susquehanna River at Havre de Grace, Md.; Philadelphia, Baltimore & Washington.

The junction of the main line with the Columbia & Port Deposit (a branch of the P., B. & W.), was thrown 1,200 ft. north at Perryville. This necessitated making extensive alterations for about 8,550 ft. and running into the old line north of Frenchtown.

All grade crossings on the main line are eliminated for this stretch of 5½ miles, and two out of three crossings on the C. & P. D. branch are now made with undergrade bridges.

Between Principio and Perryville the following bridges (for crossings) have been built:

3 Overhead bridges, for private roads.
1 Stone arch of 35-ft. span over Mill Creek.
1 Stone arch of 20-ft. span for roadway and pedestrians.
2 Undergrade bridges, one over a private road, and the other over the east leg of the old "Y" of the C. & P. D. branch.

Between Havre de Grace and Oakington the following bridges (for crossing) have been built:

2 Stone arches of 20-ft. span over alleys.
1 Stone arch of 19-ft. span over a small stream.
2 Overhead bridges, one over a private road and the other over the Philadelphia and Baltimore post road.

On the C. & P. D. branch the following bridges have been built:

2 Undergrade bridges, 1 at Perryville for post road, and 1 at Frenchtown over the public road.
A 12-ft. stone arch has been extended 27 ft. 3 in. on the east side, and 33 ft. 6 in. on the west side.
A 14-ft. stone arch has been extended 16 ft. 5 in. on the river side.

The change of line (excluding the river bridge) involved the use of 30,000 cu. yds. of masonry and necessitated 745,000 cu. yds. of excavation. The masonry is all of Alleghany Mountain sandstone with granite bridge seats.

GENERAL NEWS SECTION

NOTES.

The Governor of New York has signed a bill creating a grade crossing commission to deal with the grade crossing problems at Niagara Falls.

The trunk lines have agreed that from June 1, $2 demurrage will be charged on carloads of grain held at intermediate points for reconsignment, unless the delay is less than 48 hours.

The Georgia Railroad Commission, on May 10, issued an order putting the Seaboard Air Line Railway in class B, instead of class C, thus requiring a reduction of 10 per cent. in its freight rates.

The railroads south of the Potomac and Ohio rivers, and east of the Mississippi, will probably announce party tickets at 2½ cents a mile for 10 to 19 persons, and at 2 cents a mile for 20 or more.

The two houses of the legislature of Illinois agreed, May 10, on a 2-cent fare law, and the bill was sent to the Governor. From passengers paying cash fare on trains it will be legal still to collect 3 cents a mile.

The Oregon Short Line is to put up rest houses for its employees at Pocatello, Montpelier and Glenn's Ferry, Idaho. The largest of these houses, that at Pocatello, will be 56 ft. x 73 ft., and two stories high.

The railroads running east from Chicago have announced that from June 1 lumber will be charged at sixth class rates, which, to New York, will be an increase of 25 per cent.; to Philadelphia, 27.7 per cent., and to Buffalo, 20 per cent.

The new passenger steamer "City of Cleveland," under construction at the plant of the Detroit Shipbuilding Company for the Detroit & Cleveland Navigation Company, and intended to run between Detroit and Cleveland, was destroyed by fire on May 13; loss $700,000. The vessel was designed to carry 4,500 passengers.

The Supreme Court of the United States has sustained the decision of the Interstate Commerce Commission disapproving an advance in the freight rates on soap shipped by the Procter & Gamble Company, of Cincinnati. The proposed increase, about 17 per cent., was made by changing the classification from fourth class to third.

Judge Pritchard, in the United States Circuit Court, at Richmond, Va., May 9, in a suit brought by the Southern Railway, granted a temporary injunction, returnable June 27, restraining the Virginia State Corporation Commission from reducing passenger fares in that state. A similar order was granted to restrain the officials of the state of North Carolina from reducing either freight or passenger rates on the Southern Railway.

An officer of the Union Pacific says that he looks for a greater coal famine next year than ever before. "The Union Pacific Railroad, which has always taken care of the people along its lines, will no longer be able to do so, on account of the new law. The small dealers have in a way depended on the railroad supply of coal to help them out, and unless they store their own coal during the coming summer they will face a famine in the winter. The Union Pacific will store coal as usual this summer, but will have none to sell."

In the case of the city council of Atchison, Kan., against the Missouri Pacific, the Burlington and the Atchison, the granting of certain allowances or free service in the elevation, transfer, mixing, cleaning and other handling of grain at Kansas City, Leavenworth and Kansas City, which are withheld at Atchison, is declared by the Interstate Commerce Commission unlawful. The carriers should not furnish at Kansas City, Leavenworth or Argentine, elevator allowances or other free service in connection with the shipment of grain which are not furnished at Atchison.

The Interstate Commerce Commission has denied the plea of Southern cotton manufacturers for a reduction of the rates on cotton goods from that section to the Pacific Coast. The opinion, by Commissioner Lane, says: "The fact that such rates are higher than from the New England states does not of itself establish the unreasonableness of the higher rates. The New England mills are entitled to such advantage as they have from being closer to ports where cheap water competition has been established. The existence of a lower rate in the somewhat remote past does not necessarily prove anything of value in ascertaining the reasonableness of a rate existing to-day."

The Interstate Commerce Commission, in a case against the Chicago, St. Paul, Minneapolis & Omaha, and its connections eastward, has decided that a rate of 62 cents on rugs from St. Paul to Boston, by way of Duluth and the Mutual Transit Company's steamers, when there was in force at the same time from St. Paul a lake and rail rate, via Lake Michigan, of 45 cents, and an all rail rate [via Chicago] of 49 cents, was unreasonable; it should be only 45 cents. And yet it appears that the 62-cent rate was made up of a local rate to Duluth of 23 cents, and a lake-and-rail rate from there of 39 cents.

Eight railroads in the South have granted an increase of 6 per cent. in the wages of enginemen of freight trains, and 10 per cent. in those of enginemen on passenger and switching engines. The roads are the Atlanta & West Point, the Georgia, the Central of Georgia, the Southern, the Seaboard Line, the Georgia Southern & Florida, the Atlantic Coast Line and the Mobile & Ohio. The increase of pay recently granted on the New York, New Haven & Hartford is said to amount to 10 cents a day for brakemen, bringing the rate up to $2.20; 15 cents a day for baggagemen, making their pay $2.25; and 20 cents a day for yardmen, who will now receive $2.40 for eight hours.

In the United States District Court at Wilmington, N. C., May 11, the Laurinburg Oil Company and the Lumberton Ginning & Oil Company, were fined $10,000 and $5,000 respectively for having obtained a freight rate lower than that in legal effect by means of false certification of weights. At the suggestion of Attorneys Skinner and Walter, the cases as to the officers and directors of the mills were nolle prossed, with the exception of that of R. E. L. Correll, Superintendent and Manager of the Lumberton mill, for whom the corporation would not become responsible. The case as to Correll was continued to the October term. The cases have attracted attention as the first of their nature instituted by the commission against the shipper and not the transportation company.

Attorney-General Bonaparte has brought suits against 25 railroads to recover penalties for violation of the safety appliance law as follows: Alabama & Vicksburg; Atlantic Coast Line (25 violations); Atchison, Topeka & Santa Fe; Belt Railway of Chicago; Chicago & Eastern Illinois; Chicago, Burlington & Quincy; Chicago, Indianapolis & Louisville; Cleveland, Cincinnati, Chicago & St. Louis; Evansville & Terre Haute; Florida East Coast; Gulf & Ship Island; Illinois Central (46 violations); International & Great Northern (13 violations); Louisville & Nashville; Louisville, Henderson & St. Louis; Missouri, Kansas & Texas Ry. Co. of Texas; Mobile & Ohio (43 violations); Morgan's Louisiana & Texas; Nashville, Chattanooga & St. Louis; New Orleans & North Eastern Railroad Co. (11 violations); Peoria & Pekin Terminal; St. Louis & San Francisco; Seaboard Air Line; Texas & Pacific; Yazoo & Mississippi Valley (28 violations).

In the United States Court at Montgomery, May 8, preliminary injunctions were granted in the suits of ten roads in Alabama, restraining the state from putting into operation the rate laws just enacted. Continuance was taken in the application of the Louisville & Nashville because of its having made rates in violation of the law, which says that rates in effect January 1 last shall be the maximum charge. This feature was continued for 30 days by request of the state. The roads which secured the injunction are the Atlantic Coast Line, the Seaboard, the Central of Georgia, the Western of Alabama, the Alabama Great Southern, the Southern, the Mobile & Ohio, the Atlanta & Birmingham, the St. Louis & San Francisco and the Nashville, Chattanooga and St. Louis. The law in question would make the rates in force Jan. 1, 1907, the maximum rates; fixes rates on 110 articles, classifies the roads and provides for the abrogation of license of any road removing a case from the state to the federal court.

The Supreme Court of the United States, reversing the decision of the Court of Appeals of the state of Kentucky, has sustained the contention of the Adams Express Company that the state of Kentucky cannot interfere with the traffic in whisky between Ohio and Kentucky as carried on by the express company. It appears that to consumers in places in Knox and Laurel counties, where there is a state prohibition law, liquor is shipped c.o.d. from Cincinnati which is not ordered by the consignees, and the express company delivers the goods in such a way that the consignee does not know the name of the shipper. The Cincinnati liquor men procure the names of the users of liquor in the prohibition counties and keep on hand for them at the local express offices a constant supply of intoxicants, to be delivered to them whenever paid for, and the system is said to result in turning many of the express offices into liquor storehouses on a small scale. The express companies claimed that they were only common carriers, obliged under their contracts to make collections on c.o.d. packages. Justice Brewer, writing the decision, held that the traffic is interstate commerce, and hence not subject to state regulation. Justice Harlan dissented.

Electric Trains Under the Detroit River.

For the operation of the Detroit river tunnel, now being built for the Michigan Central, the electrified zone will be 4.6 miles long and will comprise with the yards some fifteen miles of track. Six 100-ton direct-current locomotives of the swivel-truck type, with geared motors, will comprise the initial equipment for hauling both freight and passenger trains. Each locomotive will be capable of hauling a 900-ton train up a 2 per cent. grade at a speed of 10 miles an hour. Four 280-h.p. motors will be mounted on each locomotive; two motors being placed on each of the two swivel trucks, with a multiple unit control system to enable the locomotives to be operated singly or in train. Automatic, high-speed air-brakes will form a part of the equipment. The electrical equipment for the locomotives as well as for the tunnel, in general, will be furnished by the General Electric Company.

Power for operating the system will be purchased from the Detroit Edison Company, and will be delivered to a sub-station at Detroit at a potential of 4,400 volts, and at a frequency of 60 cycles. At the sub-station two 1,000-k.w. synchronous motor generator sets will be installed for supplying direct-current to the third rail. Each of these sets will consist of a 1,000-k.w., 4,400-volt, three-phase, synchronous motor, direct-connected on a common base to a 1,000-k.w., 650-volt, compound wound, direct-current generator. A 15-k.w., 125-volt exciter for the synchronous motor will be mounted on a shaft extension of each of the motor-generator sets.

A complete electric lighting and electric pumping equipment forms a part of the project. The yards and approaches to the tunnel will be lighted by arc lamps. The tunnel will be lighted by incandescent lamps arranged on duplicate circuits. Alternating current from the main power supply at a frequency of 60 cycles will be used on the lighting circuits. To insure an uninterrupted lighting service the lighting circuits in the tunnels are so arranged that half the lamps in both tunnels will burn if, by chance, either of the lighting circuits in the tunnels should be broken. A single three-phase distributing circuit will run through each tunnel and from these circuits suitable connections will be made to step-down transformers. The secondaries of the step-down transformers will be interconnected with duplicate circuits for half the lamps in each of the tunnels.

Five sumps will be provided in the tunnel, each sump drained by induction motor centrifugal pumps arranged in duplicate. The motors on the pumps will operate directly at 4,400 volts and the controlling circuits with compensators will be centralized in the sub-station. For indicating the amount of water in each sump, a float system will be provided having both visible and audible indicating devices in the sub-station.

At the sub-station a regulating storage battery will be provided to carry the fluctuations of the load. If the main power supply from the Detroit Edison mains should be interrupted this storage battery will have sufficient capacity to operate the entire system for half an hour. In such an emergency, the lighting and pumping alternating-current equipment will be energized by 60-cycle, alternating-current from a 50-k.w. motor-generator set, the driving motor being supplied with current from the storage battery. Flexible switching arrangements will enable this interchange of power supply to be easily and quickly made.

A Grasping Corporation vs. the Down Trodden People.

If members of the Bala Golf Club cross the Pennsylvania Railroad tracks, which divide the club grounds into two sections, they will henceforth do so at their own risk. After a personal inspection of the links, Judge Staake has decided that the crossings were dangerous and sustained the recent action of Common Pleas Court No. 5 in granting an injunction to the railroad company restraining the golfers from using them. If balls are driven across the tracks by the players and they want to recover them they must run the risk of being run down by any of the 80 or more trains which pass through the grounds daily. Women players especially, the court said, were particularly liable to death or injury on the tracks, for the reason that, becoming absorbed in the game, they could easily be run down by trains they did not see approaching.—*Philadelphia Public Ledger.*

Description of Real Reciprocal Demurrage.

The railroads have just fixed the charges against each other for failure to return cars so high that greater promptness is assured. The same must be done with like charges against shippers. Nobody wants you to pay demurrage; just release the cars. That is the only object, not revenue. This is not understood by the advocates of what is miscalled "reciprocal demurrage" with respect to car supply. The shipper has a car in his possession which he will not load or unload promptly, so as to set it free for other service. A per diem charge is made against him—a penalty for not doing what he ought to and can do. So, they say, the railroad should be made to pay the like amount when it does not promptly furnish a car to the shipper when requested.

If the railroad had a car which it could furnish and would not, the cases would be alike and a charge might be called "reciprocal." But the very life of a railroad is in getting empty cars loaded. It would be suicide to withhold them from shippers. We do not fine people for not doing what they wish to do but cannot.

If the penalty is to be for not having constantly on hand cars enough to meet all requests then say so, but do not call it "reciprocal demurrage." Reciprocity would be this: If you make the railroad pay the shipper when it has no car for his load, then a reciprocal charge would be to make the shipper pay the railroad when he has no load for its car, as is often the case when crops fail or trade is dull; and surely nobody would propose that.—Judson Harmon, Receiver, C., H. & D.

Stewart Inter-Track Fence.

The accompanying illustration shows a design of inter-track and park fencing made by the Stewart Iron Works Co., Cincinnati, Ohio.

Stewart Inter-Track Fence.

It is made of special three-rib channel rail, the third rib being so placed as to give additional strength where most needed. The picket heads are made of malleable iron. The fence shown in the *Railroad Gazette* of May 3 as being an inter-track fence was, as was evident, a platform fence.

Long Island Bouquets.

On the Long Island Railroad this year only plants native to Long Island are to be used in the little parks surrounding the stations. At Patchogue a women's club, called Sorosis, is helping the station park along and the village lends its street roller and other implements. The railroad company furnishes land and labor, and brings rock from the East River tunnels for the drives and walks. About 600 trees and shrubs have been set out. The plot around the station contains about three acres, and its border of trees and bushes almost entirely hides the freight yard from view. At Nassau, on the road to Oyster Bay, 425 shrubs and 12 trees have been ordered. Bayport, Oakdale, Babylon, Merrick, Ronkonkoma, Oyster Bay and other stations already have parks.

Duff Ball-Bearing Screw Jack.

The Duff Manufacturing Co., Pittsburg, Pa., sole manufacturers of Barrett ratchet jacks, is putting on the market a new ball-bearing lifting jack which embodies new ideas and improvements, and which will be manufactured in connection with the Duff roller bearing screw jacks. The makers claim as principal features of this jack that the bearings cannot wear unevenly and that the balls are made larger than in other jacks, making operation easier and giving greater capacity. The gears cannot get out of mesh; this is most important, as any trouble of this kind would tend to derange the load and destroy the jack. Each of these new jacks has an additional bearing on the bevel pinion, insuring great ease of operation. The ball-bearing jacks are made interchangeable with the roller bearing jacks which this company has been building for several years so that it is possible to use roller bearings in place of ball bearings when desired. The jacks are designed to cover all purposes and provide any bearing that the purchaser may specify.

P. R. R. Cultivated Forests.

The Pennsylvania Railroad now has about 1,000 acres of land planted with trees, having just begun setting out the 550,000 which will complete this amount. At Mount Union, Pa., about 225,000 trees are being planted. At Altoona 250,000 or more red oak trees are being set out. At Hollidaysburg a "forest nursery" is being created, about 135 lbs. of seed being planted this year in nursery

beds, and many trees being set in nursery rooms for use next year. The total number on the 1,000 acres under cultivation is 2,250,000. The planting is done with great attention to scientific detail, under the supervision of the company's recently appointed forester, Mr. E. A. Sterling, formerly of the United States Bureau of Forestry.

The selection of species for each planting site is determined by the character of the ground and the suitability of the trees for ties and posts. Some of the seeds, such as catalpa and locust, will produce material useful for posts in 15 to 20 years, but others, such as Scotch pine and red oak, which will be grown for ties, will not be ready for cutting in less than 30 or 40 years. Chestnut is also being used. Its seedling will take nearly as long as red oak to mature, but the sprout growth, which will be depended on later in natural forests, will grow in about 20 years. These latter species are planted upon the theory that by the time they are full grown ties will be more generally and successfully treated with preservatives, for without that treatment such ties would be of secondary value. The Pennsylvania Railroad System now uses 5,000,000 new ties every year, and their average cost is 70 cents.

Railroad Business by Daylight.

"The public character of a railroad makes the control of it a public as well as a private trust in every hand that holds it, whether the hand be chosen by a court or otherwise. Let it be understood that there are no favors going, open or secret, but that it is fare and fare alike all around. And if the business committed to me by the courts shall suffer from this cause, either at the hands of public officials or those of rival lines, the reason will be plain to a wayfaring man and the lesson will be worth to the country all it costs. I was met by many outcries as I proceeded to enforce my policy by discarding all old arrangements which I thought conflicted with it and refusing to make new ones. But there was the law. When the people found I was really in earnest, and that all were treated fairly and alike, they loyally supported me. If I lost business by the course I took there was no evidence of it. Then it was my luck—perhaps I might claim a slight share of credit for it—that the general awakening shortly came to my aid."—Judson Harmon, Receiver, C., H. & D.

The Great Salt Lake Cut-Off.

The "Lucin cut-off" of the Southern Pacific, the 30-mile trestle bridge across Salt Lake, Utah, is to be called hereafter the "Great Salt Lake cut-off," to indicate to the uninformed just where the bridge is located. This causeway has now been in service four years and has stood up so well that to-day unless the traveler looks out of the window he would not know from the motion of the train that he was on a bridge. This is just as true of the 12 miles of open trestle as it is of the filled-in parts of the line. Tied, braced, floored and ballasted, the 40,000 piles that support the cut-off high above the water are as sound as when they were transplanted from forest to lake. The 16-ft. bridge is still as level as a floor.

The regular daily traffic over the cut-off is five eastbound and five westbound passenger trains, and seven eastbound and seven westbound freights, and there are many special freight and passenger trains, every one of which gains from one to seven hours by the cut-off route, which saves 43 miles and the heavy grades of the old line running around the lake. The $4,500,000 that the Southern Pacific spent on this cut-off is one of the most profitable investments ever made by a railroad.

Saw Ties; Do Not Hew Them.

Farmers and wood choppers along the Pennsylvania Railroad who have been furnishing the road ties, for the railroad's use, have been requested to have the ties sawed instead of hewn, as has been the custom. Husbanding of available tie material, which is rapidly disappearing, is the reason given by the railroad for this suggestion.

In the report of a forestry expert just made public, the farmer is shown where he can save money by having his tie timber sawed, even though he haul it some distance to a mill. It is shown that, while a timber 16 ft. long and 15 in. in diameter will make only two ties when hewn, with no saving of material, that same timber, if sawed, would produce four ties and at the same time produce 57.6 board feet by lumber, which would have been lost through hewing.

The Pennsylvania Railroad is using more than 5,000,000 wooden ties yearly, and the saving of timber, should tie producers heed this warning, is material. It is a common belief, and generally true, that wood with a sawed surface is more susceptible to decay than a hewed surface. The fuzzy surface is to some extent a prepared substance for spores; but a hewed tie usually has scoring marks which serve the same bad purpose. The portable sawmill is a perfected machine of such small cost that it is economically available for owners of timber lands.

Disastrous Derailment at Honda, Cal.

In the derailment of a special train, carrying an excursion, about 2 o'clock on the afternoon of May 11 at Honda, Cal., on the Coast division of the Southern Pacific, about 60 miles north of Santa Barbara, 16 or more passengers and four trainmen were killed and 33 passengers were injured. The cause of the derailment is given as a defective switch, but this statement lacks the endorsement of any competent authority. The train was running at high speed. Most of the killed and injured passengers were in the dining car, which was at or near the front end of the train; and many of the killed and injured were scalded. Nearly all of the killed were residents of Reading, Pa., from which place the larger part of the excursion started. The wreck took fire but the flames were soon extinguished.

Manufacturing and Business.

William T. Dunning has been elected a Director and Secretary of the Chester Steel Castings Co., Philadelphia.

The New York office of the Standard Railway Equipment Co., St. Louis, has been moved from 122 Liberty street to 90 West street.

Among orders recently received by the Bliss Electric Car Lighting Company, Milwaukee, is one from the Baltimore & Ohio for the equipment of the Royal Blue Limited trains.

The general offices of the Magnus Metal Company have been moved from Buffalo to New York, and the company no longer maintains an office in Buffalo. The new address is 111 Broadway.

G. P. Blackiston has resigned from the Crucible Steel Company of America, with which company he has been connected for the past eight years, to become President and General Manager of the Pittsburg Automatic Vise & Tool Company, Pittsburg, Pa.

The Allison, Campion, McClellan Company has been organized to engage in general engineering work as the successor of the John W. Allison Company. The offices of the company are 1625 Land Title building, Philadelphia, and 905-6 West street building, New York.

The Tennessee Coal & Iron Co. has placed an order with the Crocker-Wheeler Company, Ampere, N. J., for the complete electric motor equipment of its new steel rail mill at Birmingham, Ala. The equipment includes 15 form W rolling mill motors, and the order aggregates about 575 h.p.

The fire, which on the morning of May 9 broke out in the plant of the Falls Hollow Staybolt Co., at Cuyahoga Falls, Ohio, did considerable damage to part of the roof of the main building, but within two days the plant was running at its usual capacity and the filling of orders will not be delayed.

The exhibit of the Allis-Chalmers Company, Milwaukee, at the Jamestown Exposition, includes a portable air compressor built on the principles of the Christensen compressor. It is built for capacities of 11, 16, 20 and 50 cu. ft., and is furnished mounted on an ordinary four-wheel platform truck. It is adapted to use in small shops, where the need for compressed air does not warrant a large stationary compressor.

The General Railway Signal Company, Rochester, N. Y., has received the contract for all the signal and interlocking appliances to be installed in the tunnels of the Hudson Companies. The first section to be signaled consists of the double-track line about 2½ miles from the terminal station at Henderson street, in Hoboken, N. J., through the completed tunnels under the Hudson river to the foot of Morton street, New York, and through to the station at Christopher and Greenwich streets, a total of about 5¼ miles of track. The contract calls for the complete installation on this section of the signal apparatus, ready for operation, by September 1, when it is expected that trial trains will be run. The contract also includes the signal apparatus in the river tunnels and terminal station at Cortlandt street, and in the extension of the Morton street tunnels north under Sixth avenue to the terminal station at Thirty-fourth street. These parts of the system will not be completed for some time. The road is to be operated with direct current, using the third rail, and trains of two or more cars will be run. The alternating-current track-circuit apparatus of the General Railway Signal Company, which has been installed in the electric zone of the New York Central, will be employed, with some slight modifications. The automatic block signals are to be arranged with double overlap, and the Kinsman automatic stop. The latest form of Kinsman contact rail and shoe apparatus will be employed, the contact rail for the automatic stop being placed outside of the track rails and between them and the third rail. The arrangement and location of signals has been carefully worked out in connection with the calculated speed diagram throughout the tunnels, and the signals will be spaced to permit a minimum headway of 1½ minutes, although in some places there are sharp curves and some grades

as steep as 4½ per cent. This contract is the largest so far placed for signals on electrically operated roads.

Iron and Steel.

The New York Central lines will probably give orders soon for between 100,000 and 200,000 tons of rails.

The Harriman Lines have ordered 150,000 tons of open hearth rails from the Tennessee Coal & Iron Company for 1908 delivery. Of these 110,000 tons are for the Union Pacific and Southern Pacific systems and 40,000 tons for the Illinois Central.

The Pennsylvania has given orders for 142,600 tons of Bessemer rails for 1908 delivery, as follows: United States Steel Corporation, 71,500 tons; Pennsylvania Steel Company, 30,500 tons; Cambria Steel Company, 30,000 tons, and Lackawanna Steel Company, 10,600 tons.

The King Bridge Co. has an order from the New York Central for a rolling lift bridge to be erected at Hamburg, N. Y. It is estimated that this contract will require about 400 tons of bridge steel. The American Bridge Co. has taken orders for about 4,000 tons of bridge work from the Illinois Central, and the McClintic-Marshall Company 1,100 tons for another road.

The Illinois Steel Company, it is said, has orders for 75,000 tons of rails from the Chicago, Milwaukee & St. Paul; 45,000 tons for the Chicago, Burlington & Quincy; 25,000 tons for the Chicago, Rock Island & Pacific; 5,000 tons for the New York, Chicago & St. Louis, and 5,000 tons for the Chicago & Eastern Illinois, for 1908 delivery. About 100,000 tons additional are under negotiation.

OBITUARY NOTICES.

Albert Keep, formerly President of the Chicago & North-Western, died at his home in Chicago on April 12.

Frank H. Goodyear, President of the Buffalo & Susquehanna, died in Buffalo on April 11 after a long illness.

Nathan Guilford, who resigned as Vice-President of the New York Central Lines in charge of traffic last December, on account of ill health, died on May 11 at his home in Yonkers, N. Y., of bronchitis. Mr. Guilford was born in Cincinnati on February 7, 1841. He began railroad work in 1859 as a clerk in the freight department of the Little Miami Railroad, a subsidiary of the Pennsylvania. From 1869 to 1870 he was secretary to the President of the Little Miami, and then went to the Baltimore & Ohio as Assistant General Freight Agent. He was appointed General Freight Agent of this road in 1872, and five years later was made a member of the Western Executive Committee. In 1879 he was elected Vice-President of the Manhattan Elevated Railway in New York City, and in 1882 was made Assistant Commissioner of the Trunk Line Commission. He was Commissioner of the freight department of this Commission from 1885 to the fall of 1887, when he was appointed General Traffic Manager of the New York Central & Hudson River. His title was changed to Traffic Manager in 1898, and in 1905 he was elected Vice-President in charge of traffic of the New York Central Lines east of Buffalo.

Nathan Guilford.

MEETINGS AND ANNOUNCEMENTS.

(For dates of conventions and regular meetings of railroad conventions and engineering societies, see advertising page 24.)

American Society of Civil Engineers.

At the meeting of this society May 15 a paper by William H. Burr on "The Reinforced Concrete Bridge Across the Hudson River at Sandy Hill, N. Y.," was presented for discussion. This paper was printed in *Proceedings* for April, 1907.

New York Railroad Club.

At the meeting of this club in the new building of the Engineering Societies, 29 West Thirty-ninth street, May 17, C. L. Bardo, Assistant Superintendent New York division of the New York, New Haven & Hartford, will present a paper on "The Science of Freight Transportation."

Philadelphia Institute.

At a meeting of the Electrical section May 16 an address was made by C. O. Mailloux, of New York, on the Electrification of Steam Railways.

At the meeting of the Mechanical and Engineering section to be held May 23, an address will be made by James B. Bonner, of Philadelphia, on the Present Condition of the Work on the Panama Canal, with illustrations.

ELECTIONS AND APPOINTMENTS.

Executive, Financial and Legal Officers.

Chesapeake & Ohio.—H. T. Wickham, General Solicitor, has been appointed to the new office of General Counsel, with office at Richmond, Va. Henry Taylor, Jr., succeeds Mr. Wickham.

Chicago, Cincinnati & Louisville.—The general offices of this company have been moved from Cincinnati to Chicago.

Delaware & Hudson.—J. R. Maxwell and Frank E. Smith have been elected Directors, succeeding Frederick Cromwell and Alexander E. Orr, resigned.

Great Northern.—See New York, New Haven & Hartford.

Mexican Central.—H. R. Nickerson, Vice-President, has resigned.

New York, New Haven & Hartford.—Benjamin Campbell, Fourth Vice-President of the Great Northern, has been elected Vice-President in charge of traffic of the New York, New Haven & Hartford, effective June 1.

Pittsburg, Binghamton & Eastern.—H. A. Schwenecke, Chief Engineer, has been elected Vice-President and a member of the Executive Committee.

Pittsburg, Wheeling & Kentucky.—E. B. Taylor, Third Vice-President of the Pennsylvania Lines West, has been elected also President of the P., W. & K., succeeding W. P. Hubbard. The road is leased to the Pittsburg, Cincinnati, Chicago & St. Louis.

Southern Pacific.—A. K. Van Deventer, Assistant Treasurer, has been elected Treasurer, with office at New York, succeeding N. T. Smith, deceased.

Warren & Ouachita Valley.—The officers of this company are as follows: F. E. Weyerhaeuser, President, with office at St. Paul, Minn.; N. H. Clapp, Jr., Treasurer; C. J. Mansfield, Secretary; O. W. Wheless, Auditor; W. S. Hobbs, General Manager; all with offices at Warren, Ark.

Operating Officers.

Baltimore & Ohio.—H. R. Hamlin, chief clerk to the General Superintendent of the Pittsburg grand division, has been appointed Trainmaster of the Connellsville Terminal and of the Fairmont, Morgantown & Pittsburg, which territory is part of the Connellsville division. F. T. Moore remains Trainmaster of the rest of the division.

Chicago & Alton.—F. L. Richards, Trainmaster at Mexico, Mo., has been appointed Assistant Superintendent at Bloomington, Ill.

Chicago & Eastern Illinois.—J. Whitson has been appointed Trainmaster at Salem, Ill., succeeding G. B. Wright, resigned to go to the St. Louis & San Francisco.

Chicago, Rock Island & Pacific.—H. P. Greenough, Superintendent at Cedar Rapids, Iowa, has been appointed Superintendent at Dalhart, Tex., succeeding J. F. Sugrue, resigned.

The headquarters of the Oklahoma division have been moved from Chickasha, Ind. T., to El Reno, Okla.

Colorado Southern, New Orleans & Pacific.—W. W. Yeatman has been appointed Superintendent of the Orange division, with office at Orange, Tex.

Louisiana Railway & Navigation.—August Mann, Superintendent of the Donora plant of the United States Steel Corporation, has been appointed General Manager of the Louisiana Railway & Navigation.

Minneapolis, St. Paul & Sault Ste. Marie.—W. H. Schutt has been appointed Assistant to the General Manager.

Missouri, Kansas & Texas.—E. M. Gates has been appointed Trainmaster of the Cherokee, Osaga, Tulsa and Joplin divisions, with office at Parsons, Kan.

New York, New Haven & Hartford.—C. S. Lake, Superintendent of the Southern at Greensboro, N. C., has been appointed Superintendent of the Berkshire and Naugatuck divisions of the New York, New Haven & Hartford, succeeding J. P. Hopson, transferred.

Philadelphia & Reading.—B. Darwin has been appointed Trainmaster at Reading, Pa.

Southern.—F. P. Pelter, Superintendent at Nashville, Tenn., has been appointed Superintendent at Chattanooga, Tenn., succeeding C. C. Hodges, who takes Mr. Pelter's place at Nashville.

Texas & Pacific.—W. G. Mason has been appointed Superintendent of the Avoyelles division, succeeding H. Flanders, resigned to go to another company.

Traffic Officers.

Ann Arbor.—See Detroit, Toledo & Ironton.

Chicago Great Western.—J. H. Lyman, General Agent at Kansas City, Mo., has been appointed General Agent at San Francisco, succeeding F. O. Hatch, resigned. E. B. McGonahy, division freight and passenger agent at Chicago, succeeds Mr. Lyman.

Detroit, Toledo & Ironton.—C. P. Lamprey, General Traffic Manager of this road and of the Ann Arbor, has resigned, and his office has been abolished. H. C. Bell, Assistant General Freight Agent, has been appointed General Freight Agent.

Chesapeake & Ohio.—H. W. Fuller, General Passenger Agent, has been appointed to the new office of Passenger Traffic Manager, with office at Washington, D. C. John D. Potts, Assistant General Passenger Agent at Cincinnati, Ohio, succeeds Mr. Fuller, with office at Richmond, Va. W. S. Bronson has been appointed Assistant General Passenger Agent at Richmond, Va.

Northern Pacific.—J. C. Poore has been appointed Assistant General Passenger Agent, with office at St. Paul.

Peach River & Gulf.—E. H. Green, Jr., has been appointed Traffic Manager, with office at Timber, Tex., succeeding M. M. Riner, resigned to go into other business.

San Pedro, Los Angeles & Salt Lake.—Thomas C. Peck, Assistant General Passenger Agent, has been appointed General Passenger Agent.

Tehuantepec National.—E. H. Moore has been appointed General Freight and Passenger Agent, succeeding E. M. Cousin, resigned.

Engineering and Rolling Stock Officers.

Birmingham Southern.—R. C. White, Master Mechanic, has resigned to go into other business.

Erie.—G. B. Owen has been appointed Engineer of Maintenance of Way, with office at Jersey City, N. J., succeeding James Burke, transferred. A. Swartz has been appointed Division Engineer at Huntington, Ind., succeeding A. Crable, transferred.

Mexican Railway.—J. B. Cozart has been appointed Master Mechanic at Atizaco, succeeding E. I. Shipp, resigned.

New York Central & Hudson River.—The territory in charge of C. E. Lindsay, Engineer of Maintenance of Way of the electric division, extends from Fifty-seventh street, New York City, to Mount Vernon and Kingsbridge. H. S. Balliet, Engineer of Maintenance of Way of the Grand Central Station, is in charge of the rest of the Electric division, and has been appointed also Signal Engineer of the Electric division.

Vandalia.—F. H. Watts, Engineer of Maintenance of Way at Logansport, Ind., has been appointed Engineer of Maintenance of Way at Indianapolis, succeeding A. R. Holliday, resigned.

LOCOMOTIVE BUILDING.

The Illinois Steel Company, Chicago, is in the market for one locomotive.

The Great Northern has reserved space with the Baldwin Locomotive Works for 100 locomotives.

The Colorado Midland has ordered six consolidation locomotives from the Baldwin Locomotive Works.

The Lake Superior & Ishpeming has placed an order for locomotives with the Baldwin Locomotive Works.

The Boston & Albany has ordered 10 consolidation, nine Pacific, eight double end and nine switching locomotives.

The Toledo, St. Louis & Western has ordered six switching locomotives from the American Locomotive Company.

The Brooks & Ross Lumber Company, Chicago, has ordered one locomotive from the American Locomotive Company.

The Intercolonial, it is reported, has ordered 10 consolidation locomotives from the Canadian Locomotive Company.

The Carthagena-Magdalena Railroad, Colombia, has ordered two Shay locomotives from the Lima Locomotive & Machine Co.

The New Orleans Terminal denies being about to buy two switching locomotives, as reported in the *Railroad Gazette* of May 3.

The St. Louis, Springfield & Oklahoma Western, a projected 250-mile line, expects to ask bids on rolling stock within the next 60 days. C. S. Stocker, Stigler, Ind. T., is President.

The Chilian Government Railways Administration has ordered 30 freight and passenger locomotives from the Baldwin Locomotive Works. The contract was made through Wessel, Duval & Co., Broad Exchange building, New York.

The Long Island, as reported in the *Railroad Gazette* of May 10, has ordered five 10-wheel locomotives from the American Locomotive Company for July delivery. The specifications are as follows:

General Dimensions.

Type of locomotive	Ten-wheel
Weight on drivers	128,000 lbs.
Total weight	167,000 "
Diameter of cylinders	21 in.
Stroke of pistons	26 "
Diameter of drivers	60½ "
Boiler, type	Straight; wide firebox
" working steam pressure	200 lbs.
Heating surface, total	2,024.64 sq. ft.
Tubes, number	272
" material	Charcoal iron
" outside diameter	2 in.
" length	13 ft. 4 3/16 "
Firebox, length	119⅛ "
" width	83¼ "
" material	Penn. R. R. specifications
Grate area	689 sq. ft.
Tank capacity for water	6,000 gals.
Coal capacity	12 tons

Special Equipment.

Air-brakes	Westinghouse
Axles	Penn. R. R. specifications
Bell ringer	Gollmar
Boiler lagging	Sectional magnesia
Brake-beams	Davis solid truss
Couplers	Tower
Headlights	Glazier 20th century
Injector	Nathan simplex
Journal bearings	Ajax
Piston rod packings	U. S. metallic
Valve rod packings	U. S. metallic
Safety valve	Crosby
Sanding devices	Leach and gravity
Sight-feed lubricators	Nathan
Springs	Pittsburg Spring & Steel Co.
Steam gages	Crosby
Steam heat equipment	Leslie Regulator
Tires, driving wheel	Midvale
" truck wheel	Steel tired
" tender wheel	Schoen

The Japanese Imperial Government Railway, as reported in the *Railroad Gazette* of May 10, has ordered 24 simple, 3-ft. 6-in. gage, eight-wheel (4-4-0) locomotives with six-wheel tenders, from the American Locomotive Company for March and April, 1908, delivery. The specifications are:

General Dimensions.

Type of locomotive	Eight-wheel (4-4-0) with 6-wheel tender
Diameter of cylinders	16 in.
Stroke of piston	24 "
Diameters of drivers	4 ft. 6 in.
Boiler, type	Telescopic
" working steam pressure	160 lbs.
" heating surface	943 sq. ft.
Tubes, number	163
" material	Solid drawn brass
" outside diameter	1¾ in.
" length	10 ft. 7½ "
Firebox, length	6 ft. 6 "
Firebox, material	Copper
Grate area	Not less than 14¼ sq. ft.
Tank capacity for water	2,000 gals.
Coal capacity	3 tons

CAR BUILDING.

The New York & Queens County (Electric) is in the market for 40 electric cars.

John Morrell & Company, Ottumwa, Iowa, recently ordered 30 refrigerator cars from the American Car & Foundry Co.

The Victoria, Fisher & Western has ordered 30 standard gage logging cars from the Marshall Car Wheel & Foundry Company.

The Canadian Northern, it is reported, has ordered 50 steel cars of 100,000 lbs. capacity from the Dominion Car & Foundry Company.

The Arms Palace Horse Car Company, Chicago, is asking bids on 12 commercial express horse cars for service on passenger trains only.

The British Columbia Mills Lumber & Trading Company, Vancouver, B. C., it is reported, is building six flat cars at its Vancouver shops.

The Rhode Island Company, Providence, has ordered 55 cars. Of this number 35 are to be delivered this summer and the rest in the fall.

The St. Louis, Springfield & Oklahoma Western expects to ask bids on rolling stock within the next 60 days. C. S. Stocker, Stigler, Ind. T., is President.

The Harriman Lines, as reported in the *Railroad Gazette* of April 5, have again revised plans on 30 steel express cars and will shortly ask for new bids.

The Colorado Midland, as reported in the *Railroad Gazette* of March 8, has ordered 100 steel underframe coal cars from the Pressed Steel Car Company.

The Grand Trunk Pacific, it is reported, has ordered 1,000 flat cars of 60,000 lbs. capacity, 20 cabooses, 12 ballast distributing cars and nine flat cars of 80,000 lbs. capacity from the Canada Car Company.

The Cauca Railroad, which is being built in Colombia by the Colombian Pacific Railroad, has ordered ten 40,000-lb. box and flat cars and ten drop bottom dump cars from the American Car & Foundry Co.

The Temiskaming & Northern Ontario, it is reported, has ordered two work cars from Rhodes, Curry & Company, and three work cars and two second-hand coaches from the Crossen Car Mfg. Company.

The Illinois Central, as reported in the *Railroad Gazette* of April 26, has ordered 500 steel dump cars of 100,000 lbs. capacity from the American Car & Foundry Co. The cars will be 36 ft. 6 in. long, 9 ft. 7 in. wide and 4 ft. 6 in. high, inside measurements.

J. G. White & Co., New York, are about to order for the Philippine Railway 15 third class 41-ft. passenger cars, forty 20-ton box cars, forty 10-ton box cars and four cabooses. The company is also figuring on buying a number of steam or gasolene electric motor cars, which, if decided on, will probably be combination baggage and first and third class passenger cars.

The Duluth & Iron Range has ordered 10 refrigerator cars of 60,000 lbs. capacity from the American Car & Foundry Co. These cars will be 36 ft. long, 8 ft. 10 in. wide and 7 ft. 7 in. high, outside measurements. The special equipment includes:

Bolsters	Common sense
Brake-beams	National Hollow
Brake-shoes	Streeter steel back, Christie type
Brakes	Westinghouse
Draft rigging	Bryan tandem spring type
Journal boxes	McCord

The Atchison, Topeka & Santa Fe, as reported in the *Railroad Gazette* of May 10, has ordered 50 bunk cars from the Chicago, New York & Boston Refrigerator Company for June delivery. These cars will measure 49 ft. 6 in. long, 9 ft. 2⅝ in. wide and 8 ft. high, inside measurements. The special equipment includes:

Brake-beams	Kewanee
Brake-shoes	American Brake-Shoe & Foundry Co.
Brakes	Westinghouse
Brasses	Hewitt
Couplers	Janney
Draft rigging	Miner
Dust guards	Soule
Roofs	Hutchins

Swift & Company, Chicago, have ordered 50 steel tank cars of 60,000 lbs. capacity from the Bettendorf Axle Company, for August delivery. These cars will be 31 ft. long and 9 ft. wide, over all. The special equipment includes:

Axles	Griffin Wheel Co.
Bolsters	Bettendorf
Brake-beams	Chicago Railway Equipment Co.
Brakes	Fitzgerald
Brasses	Harrigan
Couplers	Major
Draft rigging	Miner
Dust guards	Harrison
Trucks	Bettendorf
Wheels	Griffin Wheel Company

The Atlantic Coast Line, as reported in the *Railroad Gazette* of May 10, has ordered 50 low side gondola cars of 80,000 lbs. capacity from the Hicks Locomotive & Car Works. These cars will weigh 31,000 lbs. and will measure 35 ft. 3½ in. long, 8 ft. 6 in. wide and 2 ft. 3 in. high, inside measurements, and 40 ft. long, 9 ft. 10 in. wide and 6 ft. 6½ in. high, over all. Bodies and underframes will be of wood. The special equipment includes:

Bolsters	Cast-steel body and truck
Brake-beams	Pennsylvania deck
Brake-shoes	Christie
Brakes	Westinghouse
Couplers	Tower
Draft rigging	Farlow twin spring
Dust guards	Harrison
Journal boxes	Symington
Paint	Atlantic Coast Line standard
Springs	Atlantic Coast Line standard
Trucks	Atlantic Coast Line standard

The Wilkesbarre & Hazleton, as reported in the *Railroad Gazette* of May 10, has ordered four drop bottom gondola cars of 60,000 lbs. capacity, one flat car of 50,000 lbs. capacity, and three box cars of 50,000 lbs. capacity from the Hicks Locomotive & Car Works. The rebuilding of the gondolas will be at Huntington, Pa., and of the box and flat cars at Chicago, Ill. The gondolas will weigh 24,000 to 25,000 lbs., and will measure 25 ft. 7 in. long, 8 ft. 6 in. wide and 3 ft. 10¾ in. high, inside measurements, and 28 ft. long, 8 ft. 11½ in. wide and 4 ft. 10½ in. high, over all. The flat car will measure 36 ft. long, 8 ft. 9 in. wide and 2 ft. 10½ in. high from top of rail to center of drawbar, over all. The box cars will measure 32 ft. 9 in. long, 8 ft. 1 in. wide and 7 ft. 4 in. high, inside measurements, and 34 ft. 10 in. long, and 9 ft. 3 in. wide, over all. Bodies and underframes of all cars will be of wood. The special equipment includes:

Brake-shoes for gondolas	Christie
Brakes for gondolas and flat cars	Westinghouse
Draft rigging for gondolas	Graham
Springs, for box cars	Diamond arch bar

RAILROAD STRUCTURES.

Greenville, S. C.—The Southern has given a contract for putting up a shop at Greenville. Work is also about to begin on a new freight house.

Houston, Tex.—The Missouri, Kansas & Texas, according to local reports, is planning to spend $150,000 enlarging its terminal facilities here.

Jersey City, N. J.—The Hudson County Board of Freeholders are asking bids for a viaduct from Hoboken to Jersey City. The previous bids were rejected owing to changes in the plans. There is a fund of $1,000,000 to carry out this project.

Montreal, Que.—The Quebec, Montreal & Southern has been authorized by the Dominion Railway Commission to build a steel bridge over the Nicolet river.

Morgan City, La.—The pier work on the $5,000,000 steel drawbridge of the Southern Pacific across Berwick Bay, at this place, has been finished, and it is expected to have the steel superstructure finished and the bridge open for traffic in four months.

New York, N. Y.—The lowest bid recently opened for constructing the steel and masonry approach for the Blackwell's Island bridge was that of the Snare & Triest Company, who offered to do the work for $1,576,760. The other bidders were: Williams Engineering & Contracting Company, $1,590,000; John Peirce Company, $1,749,000; J. H. Gray Company, $1,762,000, and Frank Bradley, $1,830,425. The contract will be let as soon as the Bridge Commissioner goes over the tabulations and security offered. The lowest bidder will probably get the contract, and must begin work within five days.

Plantagenet, Ont.—The Canadian Northern Ontario has been authorized by the Dominion Railway Commission to build a steel bridge over the South Nation river at North Plantagenet.

Princeton, B. C.—The Dominion Railway Commission has authorized the Vancouver, Victoria & Eastern to construct a steel bridge over the Similkaween river at this place.

Winnipeg, Man.—Plans are about finished, and bids are to be asked May 17 by the Canadian Northern for new shops and freight yards at Winnipeg. The buildings are to be of steel, concrete and brick, and will include a 39-stall roundhouse; a foundry 100 ft. x 200 ft., and blacksmith shop 100 ft. x 250 ft., in one building; store and office building 85 ft. x 300 ft.; machine and erecting shop 160 ft. x 600 ft., with a capacity for 25 locomotives. The repair shops, all in one building 200 ft. x 535 ft., include coach 180 ft. x 200 ft., paint 80 ft. x 200 ft., boiler and wheel 190 ft. x 200 ft., and tank 85 ft. x 200 ft. In addition there is to be a freight repair shop 100 ft. x 400 ft.; planing mill 85 ft. x 300 ft.; also power house, dry kiln, lumber storage sheds and oil house, each in a separate building. There is to be a water tank with 60,000 gals. capacity, and sorting tracks with a capacity for 520 cars.

RAILROAD CONSTRUCTION.

New Incorporations, Surveys, Etc.

Burr's Ferry, Browndell & Chester.—Work, it is said, is under way on an extension of this road from its terminus 10 miles east of Browndell, Tex., to Chester, La., 70 miles. Contract let for building the entire line. It is expected that the road will be finished and in operation by next year.

Cairo & Thebes.—Bids are wanted May 22 by this company for building five miles of roadbed, bridging and concrete work between Thebes bridge and the Chicago & Eastern Illinois crossing. J. L. Armstrong, Chief Engineer, Cairo, Ill. (Mar. 15, p. 380.)

Cananea, Yaqui River & Pacific.—See Southern Pacific.

Chesapeake & Ohio.—The Raleigh & Southwestern, it is said, has filed a mortgage to secure funds for building a line from a connection with the Piney branch of the Chesapeake & Ohio at Raleigh, W. Va., up the Piney river and over the divide, thence down the tributaries of the Guyandotte river in Raleigh or Wyoming counties; also for an extension from Raleigh up Beaver creek into the Glade creek valley. Johnson & Briggs, Richmond, Va., have contracts for some of the work. The line is now under construction from the mouth of Soak creek, Raleigh County, up that stream into the valley of Winding Gulf creek. It is reported to be a project of the Chesapeake & Ohio.

Chicago City Railway.—The Board of Supervising Engineers estimate the cost of rehabilitating the line of this company during the next three years at $16,000,000, and on the Chicago Union Traction Company about $24,000,000 on the north and west sides. Of this, between $4,000,000 and $5,000,000, it is expected, will be spent for improvements within the next year.

Chicago Union Traction.—See Chicago City Railway.

DENISON, BONHAM & NEW ORLEANS.—This company, which has projected a line from Ravenna, Tex., on the Missouri, Kansas & Texas southeast to Gilmer on the St. Louis South-western and the Texas Southern, about 125 miles, it is said is asking for bids May 18 for grading 20 miles from Ravenna east to Bois D'Arc creek, in Fannin County. E. D. Steger, Barnum, Tex., is President of the company. Bids to be sent to J. T. Munson, President of the Southern Railway Construction Company, Denison, Tex.

EUREKA HILL.—Contract has been let to N. Straw for grading this proposed line from the mines at Tintic, Utah, and the new smelter to be built by Jesse Knight and associates, west to Robinson, eight miles. It will cost about $10,000 a mile to build the line.

GEORGIA & FLORIDA.—Bids are wanted May 21 by A. E. Hess, Chief Engineer of the Augusta Construction Company, 519 Dyer Building, Augusta, Ga., for grading, piling, trestle bridging, drainage, etc., on connecting links of this road between Augusta, Ga., and Madison, Fla. The bids may be for sections or for the entire work, which aggregates about 150 miles in the counties of Richmond, Burke, Emanuel, Bulloch, Toomes, Montgomery, Jeff Davis, Coffee, Berrien and Lowndes, in the state of Georgia.

GRAND TRUNK PACIFIC.—Owing to unexpected delays due to the late opening of spring, the non-delivery of ties contracted for, and failure in forwarding construction supplies promptly, the expectation that the National Transcontinental would be open for traffic to Edmonton this fall is not likely to be realized. The final completion of the road will probably be delayed by at least one year. The beginning of spring work on the western divisions will be at least six weeks later than last year. Contracts were let for ties last year to lay 1,200 miles of track, but only a small portion of the contracts have been filled. Some 200 miles of roadbed is ready for track laying, and rails are ready for practically the entire distance between Winnipeg and Edmonton, but no ties are available. The labor problem is not such a source of difficulty as was expected. The Grand Trunk Pacific has brought in over 1,500 laborers this spring, principally from Scotland. The number of men employed on the western section is 8,000.

GOTEBO & SOUTHWESTERN.—Incorporated in Oklahoma with $300,000 capital and office at Gotebo. The company proposes to build a line from Gotebo, in Kiowa County south to Frederick in Comanche County, 45 miles. The incorporators include: P. Richert, R. B. Wells, H. E. Colby and J. L. Kliewer, of Gotebo; and J. W. Onstott, of Cooperton.

GREENVILLE, ELIZABETH & WOLFS MILL.—See Southern.

ILLINOIS CENTRAL.—The Yazoo & Mississippi Valley has extended its Memphis division from Roundaway, Miss., to Lombardy, 8.2 miles.

KANAWHA & WEST VIRGINIA.—This company is now operating its road between Charleston, W. Va., and Blakesley, 39 miles.

MISSISSIPPI CENTRAL.—This company, which has completed 10 miles of its proposed extension from Hattiesburg, Miss., southeast towards Pascagoula, has 15 miles additional under construction. Contract for the first eight miles let to Bowles & Hemingway.

Work is also under way on the western extension from Brookhaven, Miss., west to Natchez, 66 miles. Contracts for this work let to the Worthington Construction Company, of Brookhaven, and the O. A. Gilson Construction Company, of Natchez. (March 15, p. 387.)

MISSOURI PACIFIC.—The Springfield Southwestern on April 20 was opened for business from Springfield, Mo., to Crane, 33.9 miles.

MORGANTOWN & KINGWOOD.—This company, which operates a line from Morgantown, W. Va., southeast to Kingwood, 30 miles, is being extended south to Rowlesburg, 20 miles. It is expected to have this extension in operation by the first of next month.

NEW ORLEANS GREAT NORTHERN.—Contracts are reported let by this company to finish its proposed line from New Orleans, La., north to Jackson, Miss., also for branches in Louisiana and Mississippi. It is expected to have the grading finished from Jackson south to Monticello by July 1, and the entire line finished south to New Orleans by September 1. Work will soon be started on the branch line east to Columbia, Miss. The new branch from Rio, La., west to Franklinton, 21 miles, has been opened for business. Last year the company built 44 miles in Louisiana and 14 miles in Mississippi.

NEW YORK SUBWAYS.—Bids were opened May 14 for the second section of the subway loop to connect the Williamsburg and Brooklyn bridges, between Canal and Broome streets in the Borough of Manhattan. The Cranford Company bid $2,150,000 for the tunnel and $60,000 for the pipe galleries, and the Degnon Contracting Company $2,800,000 and $75,000. The contract for the first section, between Pearl and Canal streets, was let to the Degnon Contracting Company for $2,952,000 and $83,000 for the pipe galleries. There are three more sections on the Manhattan side to be contracted for.

OREGON RAILROAD & NAVIGATION COMPANY.—Plans have been filed in Lewiston, Idaho, by this company, showing its right of way from the mouth of Lapwai Creek, twelve miles above Lewiston, east to the west edge of the Bitter Root Forest Reserve, approximately 75 miles, along the south bank of the Clearwater river. The proposed line, if built, would give the Union Pacific-Chicago, Milwaukee & St. Paul combination a more direct line between the Mississippi river, Portland and the Pacific Ocean.

PENNSYLVANIA.—Contracts were recently let for work on the Pennsylvania, New York & Long Island, under which name the eastern end of the tunnel and terminal improvements in the city of New York is being built. The contracts are for the section of the tunnel between East avenue shaft and Thomas avenue, Long Island City. The work is divided between Naughton & Co. and Arthur McMullen, of New York.

PENSACOLA, ALABAMA & TENNESSEE.—Announcement is reported made by this company, now operating a line from Pensacola, Fla., to Muskogee, 26 miles, that it will build an extension west to Mobile, Ala., about 50 miles.

PHILADELPHIA & WESTCHESTER TRACTION.—Local reports state that this company may eventually extend its lines into New Jersey and make an electric line to Atlantic City. It is said a private right of way has been surveyed and arrangements made for procuring capital The Philadelphia & Garretsford, a subsidiary line of the P. & W. T., recently let a contract for the building of a double-track extension a mile long, over private right of way, from Aldan to Barker avenue, Collingdale. This line begins at 69th and Market streets at the terminal of the Philadelphia Rapid Transit elevated line, and extends through Upper Darby, Garretsford and Clifton Heights to its present terminus at Aldan.

PLUM VALLEY.—An officer writes that this company has projected a line from Plum City, Wis., southeast paralleling Plum creek via Maybe Station, Porcupine and Little Plum, thence southwest to Pepin on the Chicago, Burlington & Quincy. It is undecided when bids will be asked for the work. P. M. Ingold, President, Plum City. (April 12, p. 531.)

RALEIGH & SOUTHWESTERN.—See Chesapeake & Ohio.

ST. LOUIS, SPRINGFIELD & OKLAHOMA.—An officer writes that contracts are to be let next week for part of the work, and the balance within 60 days, for its proposed line from Sallisaw, Ind. T., southwest via Stigler Junction, McAllister, Legal, Scullin and Sulphur, thence west via Davis and Duncan in Ind. T., to Lawton, Oklahoma, 250 miles. (Apr. 5, p. 500.)

SAVANNAH & SOUTHWESTERN.—Incorporated in Georgia with $7,000,000 capital to build a line from Savannah, Ga., to a point on the Gulf of Mexico and Florida. The incorporators include: D. G. Purse, L. McNeil, E. M. Frank, John J. McDonough and J. H. H. Antelman, of Savannah; H. R. Brown, C. W. Dean and W. A. Walker. The office of the company is to be at Savannah.

SOUTHERN.—This company, it is said, is about to begin laying track on an extension from Bushnell, N. C., for 17 miles west toward the Tennessee-North Carolina state line. Track has been laid from Maryville, Tenn., south one mile and work is to be resumed shortly on about 40 miles to a connection with the line running from Bushnell. Work on the piers for the bridges and the culverts in the gorge of the Little Tennessee river is under way. R. B. Oliver has a sub-contract for track laying.

The Greenville, Elizabeth & Wolfs Mill has been extended from Napanee, Miss., to Wolfs Mill, five miles.

SOUTHERN PACIFIC.—The Yaqui River division of the Cananea, Yaqui River & Pacific has been extended south to Fundicion, 45 miles from Corral. Of this 15 miles was built last year.

SPOKANE & INLAND.—The Palouse line has been opened for business from Spring Valley, Wash., south to Oakesdale, 13 miles.

SPRINGFIELD SOUTHWESTERN.—See Missouri Pacific.

SUSQUEHANNA (ELECTRIC).—This new company is said to have bought the Lancaster Railway & Light Company and proposes to build an electric line from Christiana, Pa., east to Coatesville, 12 miles.

TEMISKAMING & NORTHERN ONTARIO.—An officer writes in reference to the proposed branch from Cobalt, Ont., to Sudbury, that preliminary and location surveys have been authorized, but that nothing additional has been provided for in connection with this work. (Apr. 26, p. 600.)

WESTERN ALLEGHENY.—See Bessemer & Lake Erie.

RAILROAD CORPORATION NEWS.

ATLANTIC CITY & SUBURBAN TRACTION.—John L. Clawson has been appointed Receiver of this company, which owns and operates 18 miles of road between Atlantic City, N. J., and Pleasantville.

There is outstanding $750,000 stock and $750,000 5 per cent. refunding mortgage bonds of 1933 on which interest, it is understood, was defaulted February 1.

Boston & Maine.—See New York, New Haven & Hartford.

Chicago, Indiana & Eastern.—See Pennsylvania Company.

Delaware & Hudson.—The managers have authorized the issue of $10,000,000 equipment trust bonds.

Mexican Central.—See United Railways of Mexico.

National of Mexico.—See United Railways of Mexico.

New York, New Haven & Hartford.—It is believed that this company has acquired control of the Boston & Maine. See page 666. See Providence Securities Company.

Pennsylvania Company.—This company, having secured all the stocks and bonds of the Chicago, Indiana & Eastern, has made it a part of the Logansport division of the Pittsburg, Cincinnati, Chicago & St. Louis, thereby providing for the Pennsylvania system a second entrance into Muncie, Ind. The Chicago, Indiana & Eastern runs from Converse, on the P., C., C. & St. L., to Muncie, 43 miles, and had been in the hands of a receiver since September, 1904.

Pittsburg, Cincinnati, Chicago & St. Louis.—See Pennsylvania Company.

Providence Securities Company.—This company has sold to Clark, Dodge & Co. and Kissel, Kinnicutt & Co., New York, $3,500,000 50-year, 4 per cent. debenture bonds, dated May 1, 1907, guaranteed principal and interest by the New York, New Haven & Hartford. They are part of an outstanding issue of $19,911,000. The Providence Securities Company controls 272 miles of street railway in and near Providence, R. I., and Pawtucket; all its capital stock is owned by the N. Y., N. H. & H.

Seaboard Air Line.—This company has sold to Henry & West, Philadelphia, $1,300,000 series I, 5 per cent. equipment trust notes of May 1, 1907, maturing in 20 equal semi-annual installments beginning November 1, 1907. They are issued under the "Philadelphia plan," making them free from taxation and are secured on 1,000 box cars, 500 gondolas, 50 ballast cars and 10 coaches. The Provident Life & Trust Co. is trustee.

Southern Pacific.—About $36,000,000 additional preferred stock is to be issued to holders of the $197,849,258 common and $40,000,000 preferred stock to the extent of 15 per cent. their holdings on May 31, 1907. Subscriptions are to be made on or before June 15. The directors, it is announced, decided to issue the new stock after considering the following statement:

Estimated Statement of Earnings for Fiscal Year Ending June 30, 1907.

Probable earnings of company for the year ending June 30, 1907, approximately	$44,697,000
Fixed charges, including reserve for depreciation of rolling stock	18,929,000
Surplus over fixed and other charges	$25,768,000
Deduct dividends of 7 per cent. on preferred stock	2,769,000
Dividend of 5 per cent. on common stock	9,892,000
Surplus after payment of dividends about	$13,100,000

Expenditures Uncapitalized.

At the present time the floating debt of the Southern Pacific Co. is $32,300,000, of which $14,250,000 is due Union Pacific Railroad Co. This floating debt was incurred in the following manner:

Two years ago the short-term, two-fifths-year, 4½ per cent. bonds, amounting to $30,000,000, were paid off, and we have sold against them only $7,253,000, leaving of unsold bonds	$22,747,000
The Southern Pacific Railroad Co. has retired outstanding old bonds, amounting to $12,638,000, against which they have sold refunding bonds amounting to $6,167,000, leaving unsold bonds in treasury	6,471,000
The Central Pacific Railway Co. has paid three installments of notes due the United States Government, releasing refunding bonds of that company which are in the treasury to amount of	8,822,000
There is also in the treasury against which nothing has been sold G. H. & S. A. second mortgage bonds	374,000
Total capital expenditure against which nothing has been issued	$38,414,000

This more than accounts for the floating debt of $32,300,000.

Also the following free assets against which there has not been any issue of capital obligations:

Bonds and stocks, principally of oil companies in California	$10,947,183
Expended for the construction and acquisition of new lines, including about 994 miles of completed railroad (which are unmortgaged) and on about 1,635 miles of railroad on which construction is in part progressing	39,860,254
For electric railways, principally around Los Angeles and Salt Lake City	16,234,336
Rolling stock and steamships ($7,255,000, it is said, for latter)	21,854,965
Terminal real estate	13,357,464
Grand total	$140,668,202

The Directors have decided to make dividend distributions on the common stock payable quarterly hereafter instead of semi-annually, and therefore have declared a quarterly dividend of 1¼ per cent. on the common stock payable July 1.

Union Pacific.—A meeting of the shareholders is to be called next month to authorize $100,000,000 additional common stock and $75,000,000 convertible 4 per cent., 20 year bonds. There is already outstanding $196,178,700 common stock, and of the new issue $42,857,143 will be reserved for conversion into the new bonds. The convertible bonds are to be offered to stockholders of record on May 29 at 90 and accrued interest to the extent of 25 per cent. of their holdings. They are convertible up to July 1, 1917, into common stock at $175 per share, and are redeemable at the option of the company on July 1, 1912, or on any semi-annual interest day thereafter, at 102½. At the meeting of the Board of Directors on May 9, the Chairman submitted the following statement:

Estimated Earnings for Year Ending June 30, 1907.

Estimated earnings over operating expenses for year ending June 30, 1907	$32,465,000
Deducting interest on funded debt	8,645,000
Sinking fund requirements	12,000
Interest on loans	877,000
Other expenses	27,000
Will leave a surplus of approximately	$22,900,000
Add interest and dividends other than from investment securities	$854,280
Income from investment securities	12,323,000
Rental of steamships	244,000
Total income of company, say	$36,324,000
Dividend on the preferred stock	4,000,000
Dividend on the common stock	20,000,000
Over and above all requirements of every kind, there will remain something over	$12,000,000

The Union Pacific as the holder of about 45 per cent. of the Southern Pacific Company's stock, will have to take about $15,000,000 of the new preferred stock, which the directors of the Southern Pacific Co. to-day decided to offer to its stockholders, and that amount will be added to its present requirements, bringing them up to, say, $65,000,000.

The floating debt of the Union Pacific was incurred for the following expenditures, which have not been capitalized:

Construction and acquisition of new lines	$29,172,000
Payments on account of the San Pedro, Los Angeles & Salt Lake	18,050,000
Steamships "Manchuria" and "Mongolia"	5,126,000
Rolling stock	9,302,000
Lands and miscellaneous real estate	2,033,000
Total	$63,683,000

Securities Owned.

	Face Value.	Cost.	Charged on Books at
Bonds	$80,097,000	.....	$71,654,000
Investment stocks and rights	127,759,000	$131,182,000	98,273,000
Other stock	70,623,000	.....	39,311,000

The entire free assets, excluding the $29,172,000 advanced for new construction and the unmortgaged railroads are, therefore, in round figures, $243,000,000.

The company also has 1,628 miles of completed road unmortgaged, against which it is expecting to issue and hold in its treasury $70,000,000 to $80,000,000 of first mortgage bonds.

The directors have decided to pay dividends on the common stock quarterly hereafter instead of semi-annually, and therefore have declared a quarterly dividend of 2½ per cent. on the common stock payable July 1.

United Railways of Mexico.—This company, according to press despatches from Mexico City, is about to be organized as the holding company for the National Railroad of Mexico, the Interoceanic of Mexico, the Mexican International and the Mexican Central. (Dec. 21, 1906, p. 176.)